Mar. 1929

Electrical Manufacturing

Vol. 3 A Gage Publication No. 3

The Acknowledged
Standard of Quality
Since 1884

Pyroxylin Lacquers

for every industrial purpose

THE ZAPON COMPANY
STAMFORD, CONN.

CHICAGO
CLEVELAND
DETROIT

LOS ANGELES
NEW HAVEN
NEW YORK

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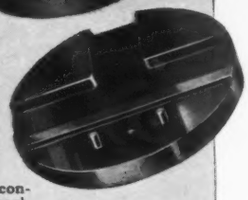
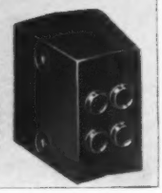
STAMFORD
WILMINGTON

Housing for automotive ignition coil, made for the Mallory Electric Corp., Toledo. The three inserts on top and the one on the side are all molded in. The cap shown at the bottom forms a very tight friction fit.

Polyphase meter terminal block made for the Duncan Electric Manufacturing Co. of Lafayette, Ind. Note that the holes enter from two sides and extend the entire depth. The finish is so perfect that no machining is necessary.



Switch block with contacts attached to horizontal connectors molded in, made for Hershey Manufacturing Co., Chicago.



This double contact brush holder, made for Teletype Corp., Chicago, is complicated because inserts are threaded inside at one end, and the other end projects from molding. Two holes are molded in at right angles to the inserts.

A Bakelite Molding Service for Every Industrial Need

Manufacturers throughout the entire country are finding Belden Molded Bakelite Products the solution of many difficult manufacturing problems.

The shapes and sizes into which bakelite can be molded by Belden are practically unlimited. Screws and studs can be inserted exactly as desired. All sorts of holes, projections, and recessions can be made so accurately and smoothly that no additional machining is required.

Belden Molded Products take a beautiful finish and are remarkably durable. Their great uniformity in size and shape not only saves additional labor but also makes for rapid assembly.

Perhaps in your products you are using wood or metal parts where bakelite would be more economical and better.

Belden Engineers will gladly help you solve your molded goods problem. Send a sample or blue print of your part. Let Belden Engineers tell you how they can give you a better part for less money.

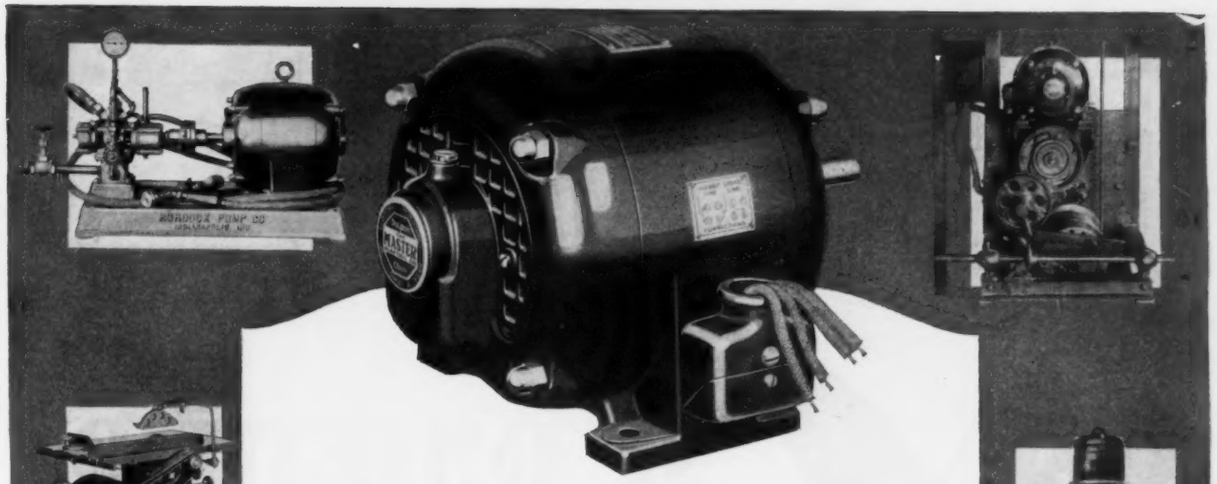
BELDEN PRODUCTS

Beldenamel and Textile Magnet Wire
Coil Windings
Beldenmold
(Molded Bakelite Products)
Automotive Wires and Cables
Airplane Assemblies
Radio Wires, Cords and Cables
Rubber Covered Wires
Armored Cables
Flexible Armature Wires
Motor Lead Wires
Braided and Stranded Copper Cables
Cotton Sleeving

Belden Manufacturing Company

2310-B South Western Ave. Chicago, Ill.

Specify Belden



Solid Background!

Behind Master Motors is a solid background of long experience in designing and building electric motors for hundreds of successful applications.

That Master Engineers—familiar, thru this experience, with every motor service condition—have designed well, is attested by the ever-growing, world-wide list of satisfied Master Motor users.

And Master Workmen—skilled, carefully trained experts in every department of good motor building—working with the finest materials—take vast pride in giving expression to Master engineering ability in a product as near electrically and mechanically perfect as it is possible to build it.

Hand in hand with sound engineering and expert workmanship goes the Master policy of continual refinement, bringing Master users long motor life, lower maintenance expense and complete satisfaction.

The Master Electric Company
DAYTON, OHIO

STOCKS CARRIED IN PRINCIPAL CITIES

More Than 70 Service Stations

MASTER GUARANTEED MOTORS

1/20 TO 10 H.P. Dayton THE MASTER ELECTRIC CO. Ohio **Less than 40°**

COMPETITION *in* QUALITY *Pays*

There has been a steady increase in the amount of Formica used by the leading electrical manufacturers for many years.

This increase has been due in large part to the fact that cheaper, less reliable materials have been replaced.

By increasing their material costs, manufacturers have reduced costs due to service, replacement and trouble, by a larger amount.

Steadily growing use of this non-absorbant, uniform and dependable insulating material, is proof that it pays to use it.

Quick service from a centrally located plant on a quality material made by an organization of specialists . . . that's what Formica offers.

FORMICA
Made from Anhydrous Bakelite Resins
SHEETS TUBES RODS

The FORMICA INSULATION CO. *4626 Spring Grove Ave.,* CINCINNATI, OHIO

Electrical Manufacturing

Reg. U. S. Patent Office

Volume 3 | MARCH, 1929 | Number 3

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ELECTRICAL MANUFACTURING'S editorial program has the following objectives:

Production

To help all electrical manufacturers, including makers of motor-driven products, increase the product's salability, cut unit production costs, quicken turnover, reduce overhead expenses, establish standard methods of work, and spread a better knowledge of raw materials and parts.

Marketing

To spread a better knowledge of and aid electrical manufacturers in adjusting sales management to the buyers' market, to aid in making advertising more effective, finding the most profitable distribution channels, and promoting cooperative market development.

Administration

To further the working out of sounder management policies and better executive control, coordinating sales and production schedules, promoting research, and developing better industry relations.

Repairing

To help all motor repair shops to build better business by developing a sounder organization, improving management, policies and methods, and developing a keener merchandising point-of-view on the business.

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SUBSCRIPTION RATES: United States, Canada, Mexico, $2.00 a year. Foreign Countries, $3.00 a year. 25 cents a copy.
Application for entry as second class matter is pending

a Dumore

eliminated unnecessary mechanism!

Motor Mounted in Firepot

The Dumore Motor set in the firepot greatly adds to the simplicity of the "ABC" Burner. It is a high-speed electric motor which is cooled by constant air currents.

THE popularity of the "A B C" Oil Burner, manufactured by the Automatic Burner Corporation of Chicago, Ill., is nation-wide . . . it is outstanding for its odorless, noiseless and automatic operation.

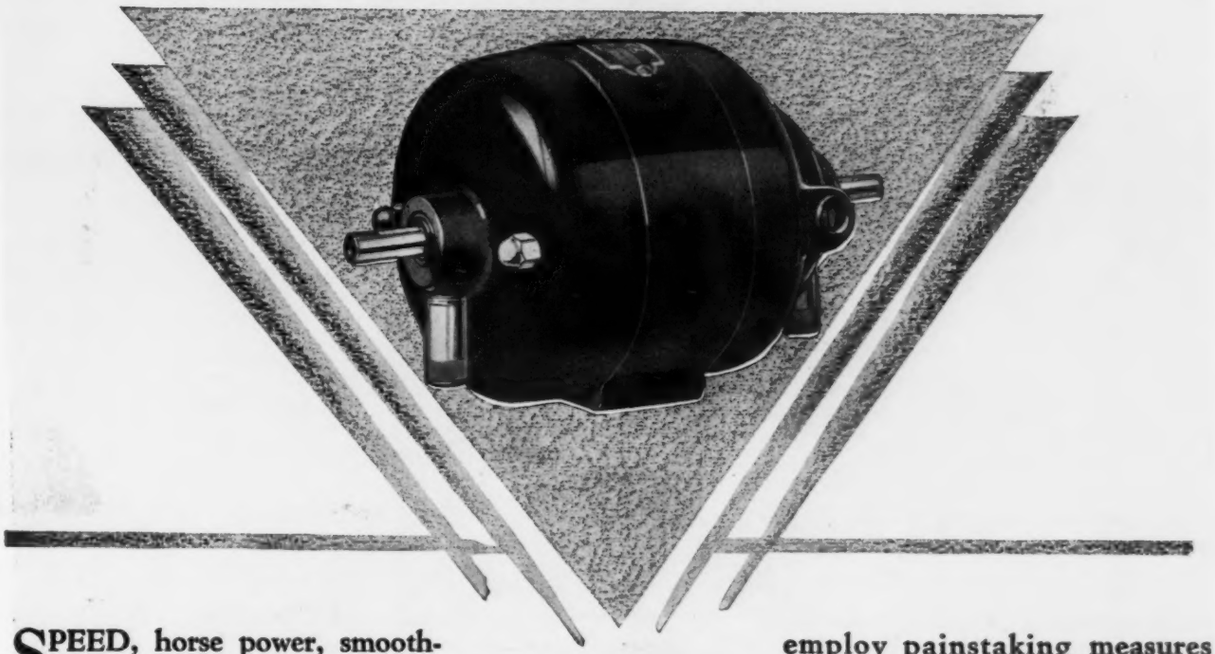
In designing the "A B C" burner, Dumore engineers were consulted. They were called upon to develop a *vertical type motor . . . one to be set in the firepot . . . one that would not "over-heat"*, a test of rare engineering ability.

Some six years ago, this specially designed Dumore Motor was built, tried, tested and proven. It was designed to inhale air in huge quantities . . . 13,500 times as much air as oil was needed for proper combustion, consequently it cools itself. Besides, *it eliminated mechanism that would otherwise be necessary.*

Dynamic balance of Dumore armatures is secured on special balancing machines of our own design and construction. Smoothness, quietness and reduction of bearing trouble to a minimum are thus assured in all Dumore Motors.

DUMORE

motor *in the firepot*



SPEED, horse power, smoothness, longer brush life, longer bearing life . . . these you expect from electric motors . . . these you are assured in Dumore Motors.

This is not an idle boast. It is a matter of record. It is the benefit of over *25 years of experience in the development of Universal high-speed motors* . . . its value . . . its assurance of *dependable performance,* year after year.

These long years of "motor-making" have taught us that you get *no more* from a motor than that which *it has.* Consequently, we employ painstaking measures to assure *quality materials* going into each motor. That is why each armature is dynamically balanced to ensure the deliverance of smooth, quiet, vibrationless power with a minimum of wear on all parts.

DUMORE
MOTORS
ARE USED IN
Electric
Vacuum Cleaners
Electric Floor Polishers
Sewing Machines
Oil Machines
Grinders
Drills
Drink Mixers
Dental Engines

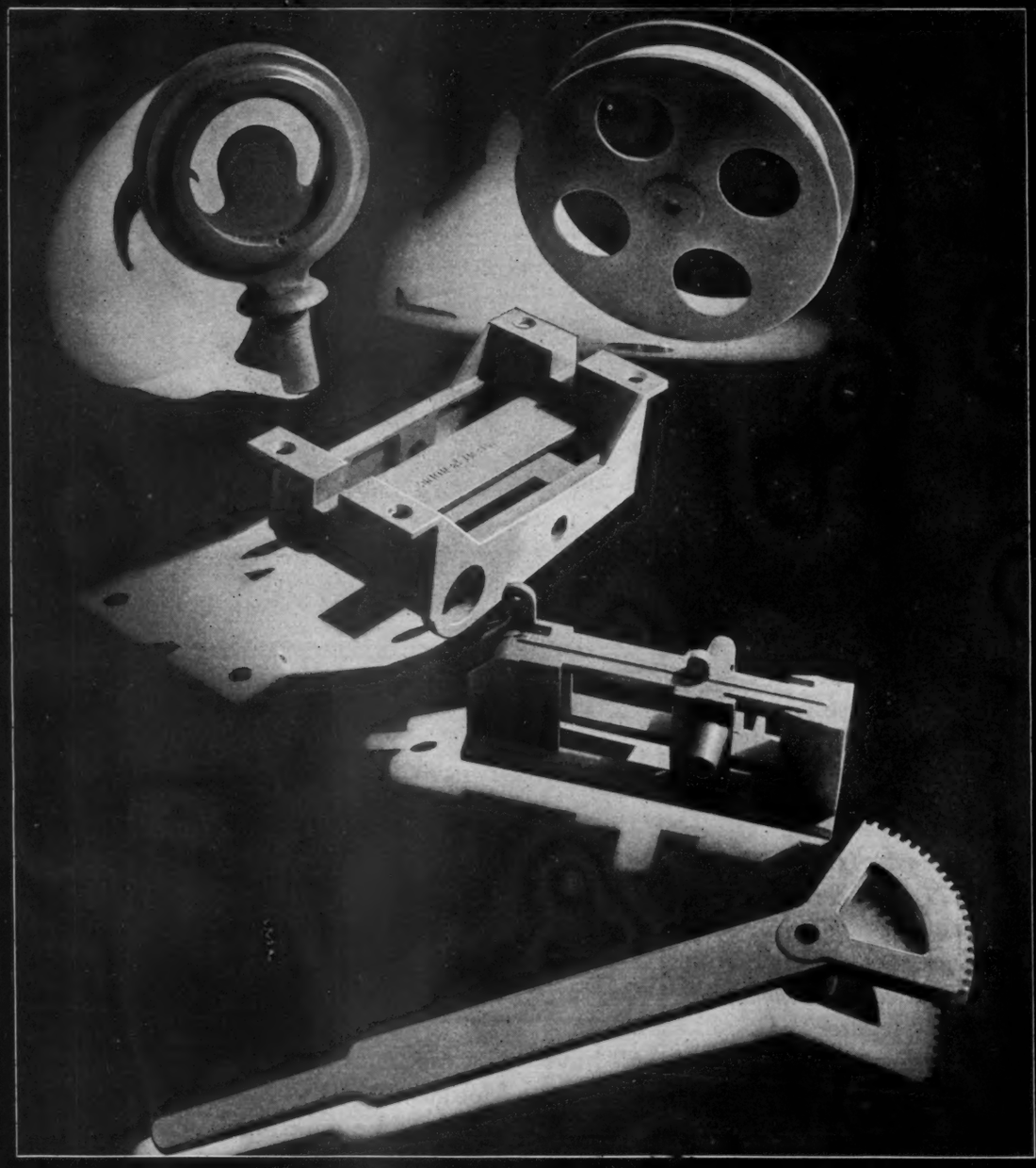
Dumore Motors obtain speeds of from 10,000 to 12,000 R. P. M., but they develop their maximum H. P. at 5,000 to 6,000 R. P. M. For full details, and how efficiently Dumore Motors will work when applied to your product, write our Engineering Research Department.

WISCONSIN ELECTRIC COMPANY
35 SIXTEENTH STREET RACINE, WISCONSIN

FRACTIONAL HORSE POWER MOTORS

HORSE HEAD ZINC

FOR THE DIE CASTING INDUSTRY



Quality? Reputation? Recognition? Sixty-five years of uniform quality have made Horse Head the standard high-grade zinc for any industry

New Jersey zinc

THE NEW JERSEY ZINC SALES CO.

160 FRONT STREET, NEW YORK CITY

ZINC METALS AND ALLOYS • ROLLED ZINC • ZINC PIGMENTS • SULPHURIC ACID • SPIEGELEISEN

Choose Your
WIRE
EVERY electrical or radio engineer knows the great importance of the proper selection of wire for every product or purpose.
Here are shown fourteen popular types of wire and insulations produced at the Dudlo plant—each made in a full range of commercial sizes.
1. Silk Covered Enameled Wire
2. Silk Covered Magnet Wire
3. "Ducotto Wire." A cotton covered wire, enameled
4. Cotton Covered Enamel Wire
5. Cotton Covered Magnet Wire
6. High Frequency Cables Litzendraht wire, enameled strands, silk covered
7. Flat Braided Cables
8. Bare or Tinned Copper Wire
9. Square and Rectangular Magnet Wire
10. Stranded and Braided Cables
11. Enameled Magnet Wire
12. Flexible Coil Leads Stranded or braided, tinned, silver plated—cotton or silk insulated
13. Antenna Wire—stranded Enameled or bare
14. Square and Rectangular Wire
New types of wire are constantly being added—special wires made to specifications—the same high Dudlo standards always rigidly maintained.
DUDLO
DUDLO

DUDLO

DUDLO MANUFACTURING COMPANY, FORT WAYNE, INDIANA

420 Lexington Ave. New York City
105 W. Adams St. Chicago, Ill.
Division of GENERAL CABLE CORPORATION
274 Brannan St. San Francisco, Cal.
4143 Bingham Ave. St. Louis, Mo.

A Great NAME *in* INDUSTRY

JOHNSON Bronze Service to Industry starts with intelligent counsel on bronze bearing problems — without obligation to the manufacturer.

It provides for the specialized manufacture, to specifications from virgin metals, of all types of bronze parts for bearing purposes.

It carries on to the point of maintaining conveniently located stocks of finished product for individual customers, and finally delivers this product ready for use at fair prices.

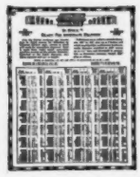
In regular production are Bronze Back Babbitt Lined Bearings, Cast Bushings and Parts, Rolled Sheet Metal Bushings, Car and Engine Castings, Cored and Solid Bar Bronze.

Manufacturers of vehicles and machinery interested in complete service of this kind should write Johnson Bronze Company, New Castle, Pa., or branches at Chicago, New York, Detroit, Cleveland, Kansas City and San Francisco.

BY STRICT adherence to the policy, "If a thing is worth doing, it is worth doing well," Johnson Bronze has earned an enviable reputation thruout the length and breadth of industry.

Charting Johnson Bronze progress up thru the past quarter century, it is unmistakably clear that this great name has been made by the consistent delivery of a quality product at fair prices when and exactly as wanted.

Today, Johnson Bronze is regarded everywhere as a specialist in the art of bronze bushing and bearing manufacture, and is thus being privileged to serve an increasingly large number of vehicle and machinery builders and users.



Write for a copy of this handy Wall Card which lists over 600 "in stock" sizes ready for immediate delivery.

JOHNSON BRONZE

BUSHINGS BEARINGS BAR BRONZE

GAIR FOLDING CARTONS

THERE was a time when gooey, sloppy soap was carried home in a can and coffee beans came in a paper bag, like roasted peanuts. That happened in the Middle Ages of merchandising, before the colorful days in which we are living. The Folding Carton now gives the necessities and luxuries of life, which so closely overlap that it is hard to discern one from the other, a badge of quality and a frank bid for better acquaintanceship. The merchandiser has been awed into deep respect for the public's critical knowledge of what is correct in line, color and design and the relentlessness with which its thumbs are turned down where consistent expertness and good taste are lacking.

ROBERT GAIR COMPANY

420 LEXINGTON AVENUE, NEW YORK, N.Y.

GAIR FOLDING CARTONS

The "seven lamps" of Folding Carton construction:

I. Generous lines. A pound is a pound, but sometimes does not look it. Do the proportions of your Folding Carton express bulk and weight impressively and correctly? Physically, your Folding Carton should resist the nudge of neighboring objects for attention.

II. Symmetry of form is akin to consistency of thought. If your Folding Carton lacks symmetry, the mind won't bother with what the eye resents.

III. Accuracy of die, bent and seam ensure a smooth-running production day in your factory. Your automatic filling machine throws the light of a searching lamp on Folding Carton construction.

IV. Design is the countenance of your Folding Carton. It must be made to stay young. Is your product for a whole generation? Then the Carton that cloaks it must be as suave in the future as it is today.

V. Color with sunshine in it, used carefully. Ivy green antagonizes ground coffee; geranium red blazes too much for a breakfast food and lemon yellow paralyzes faith in a cosmetic.

VI. Message: The concentrated light of all the lamps should focus on the message, the trade mark, the symbol that personalize your Package.

VII. Substance: Box Board of a texture, pliability and color that are in sympathy with good printing and lithography. Box Board adapted to multi-colored Cartons for fine purposes, or to the practical sort that reach the pantry shelf.

Creative and Design Department of the

ROBERT GAIR COMPANY

420 LEXINGTON AVENUE, NEW YORK, N.Y.

TORRINGTON BALL BEARINGS

PROSPECTIVE buyers of your machines go deeply into the question of operating costs. Other things being equal, the machine that operates most economically gets the preference.

Torrington Ball Bearings help your production to establish an enviable reputation in this phase of efficiency. Machines equipped with Torringtons make possible any speed up to the highest without costly friction.

Torrington Ball Bearing installations can be stressed in your sales argument. Their manufacture by the Company which has specialized with great success in the production of precision products is a guarantee of lasting satisfaction.

DISTRICT SALES REPRESENTATIVES:

S. W. ANDERSON
565 W. Washington Blvd.
Chicago, Ill.

GIBSON & HODGSON
2315 Dime Bank Bldg.
Detroit, Mich.

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.

FACTS

by which a publication's advertising worth is proven

Thirty-seven years ago ELECTRICAL RECORD set up certain standards of business paper publishing—set out to build a good product. It shunned sensationalism and catch-penny circulation methods. Its steady growth has been like that of most products which rely upon their quality alone. The inherent quality of ELECTRICAL RECORD is reflected in its long standing high renewal percentage—a true indication of reader interest and confidence. A paper which inspires such confidence in its editorial policy and contents, gives the plus value to an advertiser which adds immeasurably to the sincerity and the force of his message.

WIDE COVERAGE OF MARKET

Electrical Record has the largest *paid* circulation among individual company buyers of *any* electrical paper. (A. B. C. Statement of December 31, 1928.)

BROAD-GAUGED, AUTHORITATIVE AND INDUSTRY-ACCEPTED EDITORIAL PROGRAM

The highest renewal percentage *Electrical Record* has enjoyed continuously for many years proves reader acceptance of a well balanced editorial content. In *Electrical Record* will be found the highest proportion of editorial to advertising pages in any paper of record.

CONCRETE READER INTEREST ABSOLUTELY ESSENTIAL

Electrical Record easily surpasses any other known electrical paper in reader interest since its reader renewal percentage mark has been so much higher, consistently, for years. 72.41%, (A. B. C. Statement of December 31, 1928).

CONCLUSIVE ADVERTISER ACCEPTANCE

For years *Electrical Record* has most consistently carried not only the largest number of advertisers as a monthly, but the greatest volume of advertising directed to electrical buyers. Actual figures are available.

QUALITY CIRCULATION AS WELL AS QUANTITY

The subscribers pay 71% *more* to read *Electrical Record* than the next electrical monthly, or show preference to the extent of paying $22.143 more per year to read *Electrical Record*. This would certainly indicate preference and quality circulation.

37 YEARS OF CONTINUED DOMINANT LEADERSHIP IN THE ELECTRICAL INDUSTRY

For this long time period, the name "Gage" has been synonymous with publishing service to the electrical industry. *Electrical Record*, therefore, has a valuable industry background; a long established good-will.

Electrical Record

THE GAGE PUBLISHING COMPANY, Inc.

461 Eighth Avenue ESTABLISHED 1892 **New York, N. Y.**

"Does it come Chromium Plated?"

..that's what people are asking!...

LANDERS, FRARY & CLARK say that it does. Their Saturday Evening Post advertising announces that their well-known "Universal" line comes Chromium Plated. The U. C. Process is used.

All the better class stores are featuring articles finished with the permanently brilliant Chromium Plate...because people are asking for it!

Stores like to handle Chromium Plated ware. It never tarnishes on their shelves—it never needs polishing because it never loses its lustre—and it is easy to sell.

United Chromium, Inc., is organized to render a valuable service to manufacturers. They are invited to investigate our licensing plan and our service—which includes the supervision of the new plant installations; coaching of platers and periodic tests.

A list of our licensees authorized to use the United Chromium process will be gladly sent to manufacturers whose present needs do not justify their own plant installation but who may contemplate using Chromium plate on some of their products.

UNITED CHROMIUM
INCORPORATED

Executive Office: 51 East 42nd Street, New York City

Chicago, Ill.
4645 West Chicago Ave.

Cleveland, O.
3125 Perkins Ave.

Detroit, Mich.
322 Bellevue Ave.

San Francisco, Calif.
114 Sansome Street

Waterbury, Conn.

The Shipping Board Lines listed here, comprising a fleet of 256 vessels afford complete shipping facilities between Atlantic Coast and Gulf ports and ports in every part of the world.

***AMERICA FRANCE LINE**
42 Broadway, New York City
N. Atlantic to French Atlantic ports

***AMERICAN BRAZIL LINE**
17 Battery Place, New York City
Atlantic ports to ports in Northern Brazil

***AMERICAN DIAMOND LINES**
39 Broadway, New York City
North Atlantic Ports to Holland and Belgium

DIXIE UK LINE
New Orleans, La.
New Orleans to United Kingdom

AMERICAN MERCHANT LINES
17 Battery Place, New York City
Passenger and freight services to United Kingdom

***AMERICAN PIONEER LINE**
11 Broadway, New York City
North Atlantic ports to Orient, India and Australia
Periodically this line conducts an around-the-world service via the Suez Canal

DIXIE MEDITERRANEAN LINE
New Orleans, La.
New Orleans to Mediterranean ports

GULF BRAZIL RIVER PLATE LINE
Hibernia Bank Bldg., New Orleans, La.
Gulf ports to east coast of South America

MISSISSIPPI VALLEY EUROPEAN LINE
Hibernia Bank Bldg., New Orleans, La.
New Orleans to French and Belgian ports

YANKEE LINE
110 State Street, Boston, Mass.
North Atlantic ports to German ports

GULF WEST MEDITERRANEAN LINE
917 Whitney Building, New Orleans, La.
Gulf and South Atlantic ports to Portuguese Spanish, and North African ports (west of Bizerta)

MOBILE OCEANIC LINE
Mobile, Ala.
Mobile and Eastern Gulf ports to United Kingdom and continental European ports

AMERICAN GULF ORIENT LINE
917 Whitney Bldg., New Orleans, La.
Gulf ports to Orient and Dutch E. I.

AMERICAN REPUBLICS LINE
33 Broad Street, Boston, Mass.
N. and S. Atl. ports to Brazil and River Plate ports, east coast of S. America

ORIOLE LINES
Citizens Natl. Bank Bldg., Baltimore, Md.
North Atlantic ports to west coast of United Kingdom and Irish ports

SOUTHERN STATES LINE
925 Whitney Central Building, New Orleans, La.
New Orleans and Texas ports to German and Holland ports

TEXAS MEDITERRANEAN LINE
Cotton Exchange Bldg., Galveston, Tex.
Texas ports to Mediterranean ports

TEXAS UKAY LINE
Galveston, Texas
Texas ports to United Kingdom ports

TEXAS STAR LINE
New Orleans, La.
Texas ports to French and Belgian ports

UNITED STATES LINES
45 Broadway, New York City
Passenger, mail, freight services to England, Ireland, France and Germany

**Accommodations available for a limited number of passengers on these lines.*

GEORGE EASTMAN SAYS:

CHAIRMAN OF THE BOARD, EASTMAN KODAK COMPANY

"The Splendid Services Rendered by the American Merchant Marine Deserve the Support of American Business"

THE Freight Services operated for the United States Shipping Board offer to manufacturers and producers in this country unrivalled facilities for handling their overseas freight requirements.

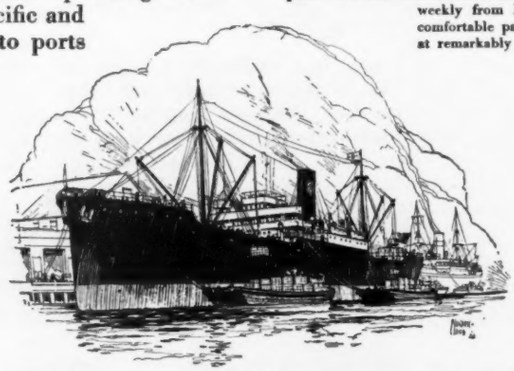
Under the direction of experienced American operators, these world-wide services have established a remarkable record for efficient and economical transportation of ocean cargo.

In addition to the twenty lines operated for the Shipping Board, there are seventeen services developed by the Shipping Board but now under private management—a combined fleet of several hundred vessels operating from Atlantic, Pacific and Gulf ports to ports in every corner of the earth.

The experienced operators of these services can help you in your export or import problems. They are capable of rendering advice to American manufacturers and producers that will be of value to them in opening up new foreign trade channels, as well as in developing their present overseas markets. You will find it to your advantage to consult with them.

Write for complete information as to rates, dates of sailing, etc.

PASSENGER SERVICES: In addition to freight services, the Shipping Board Fleet contains the fast passenger vessels of the United States Lines. Led by the S. S. "Leviathan", world's largest ship, these vessels offer exceptional accommodations to European ports. The American Merchant Lines vessels, sailing weekly from New York, offer comfortable passage to London at remarkably reasonable rates.



UNITED STATES SHIPPING BOARD MERCHANT FLEET CORPORATION

WASHINGTON, D. C.

The Result of a Real Demand

No. 110 Stool

MANUFACTURERS the country over have actually "built" ANGLE STEEL EQUIPMENT for us. They have demanded a better, more economical and more complete line than ever made heretofore. And we have given it to them in ANGLE STEEL EQUIPMENT.

You too can only realize the greatest profits, utmost production and lowest costs by standardizing on ANGLE STEEL EQUIPMENT.

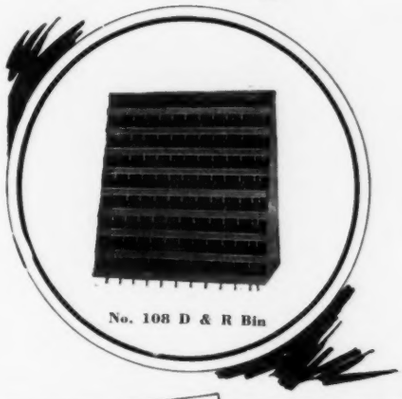
Catalog "C" will be gladly sent you on request. Hundreds of items for factory and office are described and illustrated in its 112 pages.

SPECIAL WORK—We will be glad to quote you on your specific needs on any angle steel equipment you may be planning to use. No obligation.

ANGLE STEEL STOOL COMPANY

Plainwell **Michigan, U. S. A.**

New York City—Angle Steel Stool Sales Co., 98 Park Place
Chicago—Lothrop Angle Steel Equipment Co., 325 W. Madison St.



No. 108 D & R Bin

No. 48-30 Work Bench

Permanence in Steel

ANGLE STEEL EQUIPMENT

OF STEEL

ECONOMICAL - SANITARY - DURABLE

CHICAGO'S NEW LASALLE ST. BRIDGE

RUST PROTECTION OVER THE YEARS

The new LaSalle Street Bridge — one of the high spots in Chicago's traffic arteries — is Udylited, insuring rust and corrosion protection over the years.

Whether the job is outdoors, exposed to the elements, or inside, where moisture is a factor, the Udylite process safeguards those vital parts so necessary to long life and greatest economy.

The story of how Udylite will help you solve your manufacturing problems will be sent you upon request.

Udylite
RUST PROOFS
REG. U S PAT OFF

THE UDYLITE PROCESS COMPANY Detroit Mich.
3220 BELLEVUE AVE.

STAND-BY,* *n. One who, or that which, stands by one in need; something upon which one relies for constant use.*
ACCORDING TO WEBSTER

IN June or December, in fair or stormy weather; on sidewalks that simmer with the heat, or through the icy slush of a soft, wet snow—the Mail Man makes his daily round.

We expect to see him almost with the same certainty that we anticipate the dawn of tomorrow, and for the same reason: past experience. Everyone on the street thinks of the Mail Man as an old *stand-by.

Past experience also has taught the electric heating-appliance industry to think of Chromel as an old *stand-by. Month in and month out, for almost a quarter of a century, they have found Chromel to be trustworthy and even doing a bit more than they have expected of it. They have entrusted the good name of their own product to Chromel; and Chromel, the good old *stand-by, has justified their confidence.

Chromel
MEANS ELECTRIC HEAT

In the curling-iron, or the big industrial electric furnace, Chromel heating-elements behave in a way that pleases both the manufacturer and the user. You'll find it meets every requirement that you expect—in durability, even stretch, clean finish, and uniform resistance. We can supply it in almost any temper you want, and deliver it when you need it.

For the latest technical data on Chromel, ask for our new Catalog F. M.

HOSKINS MANUFACTURING COMPANY
4445 Lawton Avenue, Detroit, Michigan
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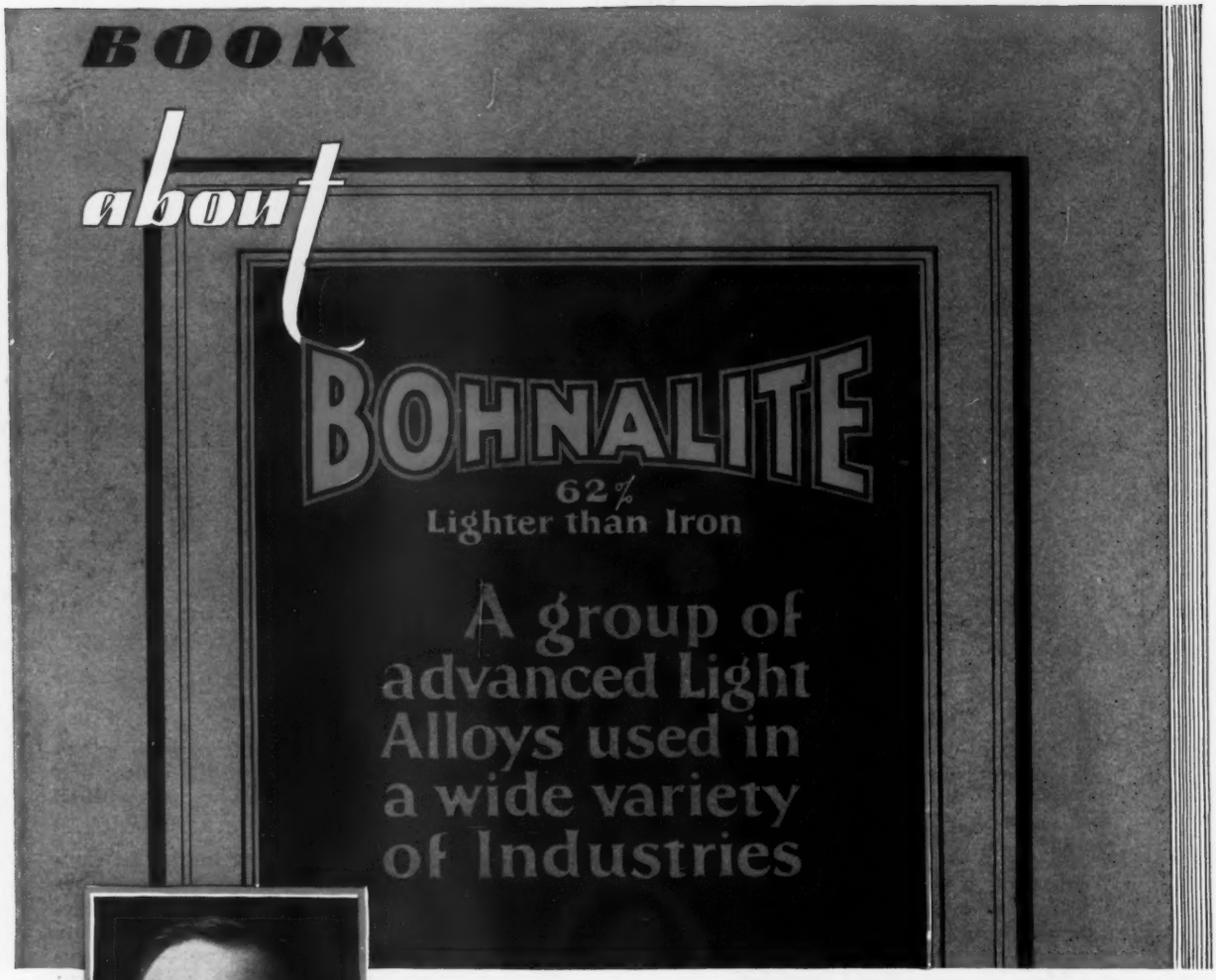

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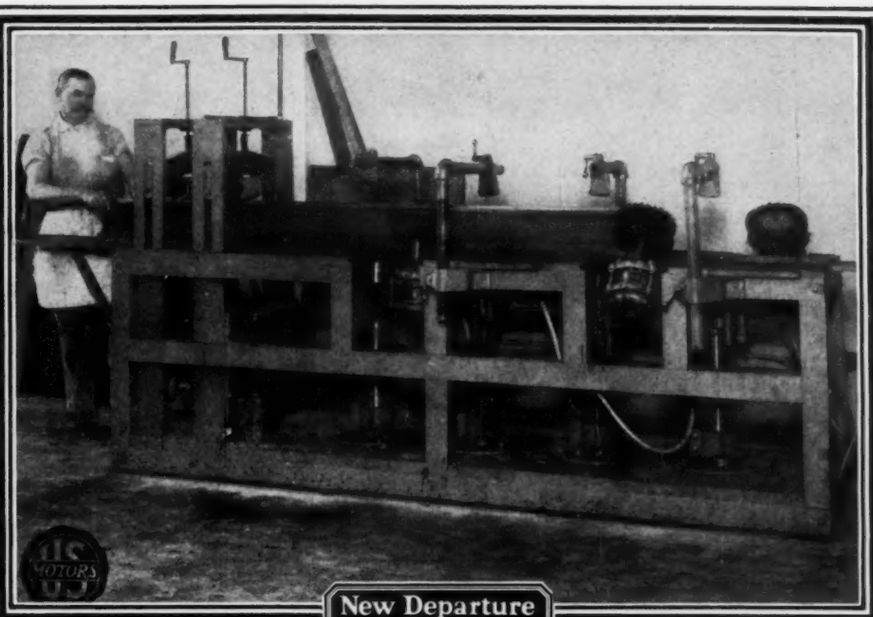

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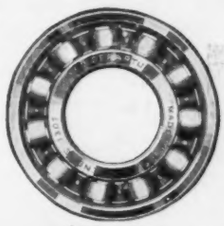

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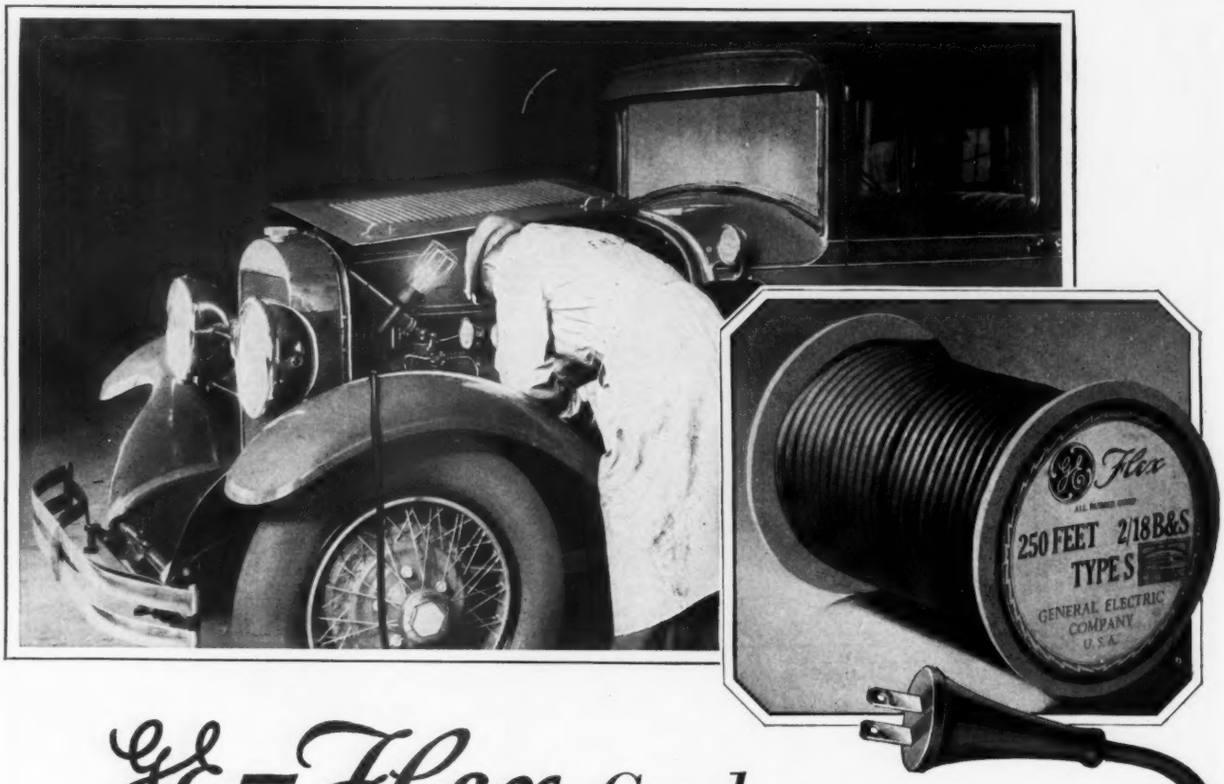

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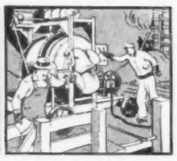

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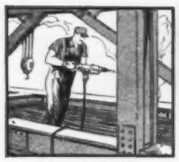

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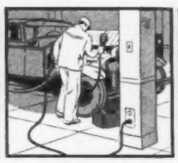

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Volume 3 MARCH - 1929 Number 3

Open Price Trade Associations

A summary of the report and recommendations of the Federal Trade Commission to the Senate

THE Federal Trade Commission sent to the Senate on February 13 a report of its investigation of open price trade associations, as directed by Senate resolution. The principal recommendations of the report are as follows:

"That the United States Bureau of the Census be given power to compel the return of statistical data needed from all manufacturers and dealers, insuring satisfactory development of trade statistics with regard to accuracy and comparability from month to month.

"That trade associations be given a definite place and responsibility in the social order by a licensing system, designed not so much as an instrument of regulation but rather as an important means of providing the Government with full knowledge of what trade associations are doing.

"That practical application of the anti-trust laws might well be clarified or extended with reference to the circulation of identified price and statistical information."

On the same date, the United States Daily carried the following analysis of the report:

"The commission believes that with the development of rules of trade practice on the initiative of associations and with the cooperation of this Commission, it is reasonable to suppose that the marketing of goods will become more and more an open and aboveboard affair, and that much of the machinery needed to find out what competitors are doing will be dispensed with. What is needed in its stead is more comprehensive trade statistics.

"A frank and aboveboard interest in the standardization of certain practices that practically, and too often covertly, affect costs to the buyer is a field for trade association activity of much promise. To keep such work free from the taint of conspiracy and illegal restraint of trade is, however, an important task for the permanent pilots of trade associations, and one in which they apparently need outside advice and assistance.

"When price information is made statistical in spirit as well as in method it comes under the definition of trade statistics as being impersonal information relating to supply and demand conditions in one or more particular industries.

"There has been a marked development of trade statistical work, largely through cooperation between trade associations and the Government since the war, and this development is bound to go much farther. There is no good reason why price statistics should not also be covered in this way. And there is a presumptive reason in the nature of trade statistics why the Government should have the authority to obtain them wherever their compilation and publication is deemed in the public interest. Government participation in trade statistics has in its favor the fact that it warrants unqualifiedly the making of the statistics available generally, instead of accepting the situation that involves attempt to use them as an advantage for sellers only.

"A general analysis of wholesale prices indicates that if some open-price associations exercise any undue control, that result does not clearly appear as a characteristic phenomenon of the available price data. This conclusion is not inconsistent with the idea that open-price associations of certain kinds work largely in the direction of uniformity and constancy of prices, but it does not appear that open-price work is the major and dominant factor in the situation generally. Industries without open-price associations, or without any association, appear to show as great a tendency to extreme stability of prices as do those affected by open-price activity."

W. C. Yates

T. E. Barnum

Nema's Work on Apparatus

Industrial control is a subject that should be of interest to every electrical manufacturer, because he makes use of it, to some extent, either in his products or in his plant

G. S. Crane

Fred I. Hange

F. T. Wheeler

H. D. James

P. C. Clark

L. A. Peterson

PROBABLY one of the most significant works of Nema thus far is its efforts toward the development of technical standards covering the construction, operation, acceptance and maintenance of industrial control equipment and related apparatus. The first step in this direction was taken in 1916, when the former Electric Power Club, now united with Nema, organized its control section. This body immediately set about in collaboration with the American Institute of Electrical Engineers to formulate certain standards for control equipment. The work of these two organizations resulted ultimately in the adoption of identical control standards by both the Electric Power Club and the American Institute of Electrical Engineers, and finally the approval of these standards by the American Engineering Standards Committee in 1925. Because of this fact the control section of the apparatus division of Nema has the distinction of being the first in the electrical group to have its standards recognized and approved by the American Engineering Standards Committee as American Standards. Now that this has been accomplished it is to be desired that these same standards be approved and adopted internationally.

One interesting fact in connection with the early work of the control section of the Electric Power Club, in connection with the development of the present standards, is that the cooperation of the American Institute of Electrical Engineers was obtained through having substantially the same men who were members of both organizations appointed on the respective committees of both bodies. Later, this cooperation between the two committees was officially recognized and joint sponsorship was obtained from the American Engineering Standards Committee.

Since its organization the control section has engaged in many activities, other than those of formulating control standards. During the late World War this section functioned as a committee, cooperating with the government in working out war standards for the industry. Some of these were later incorporated with the present standards.

Looking toward the protection of persons in the industry the Electrical Safety Conference was organized and the Electric Power Club became a member of the conference.

Members of the Industrial

Harry L. Bradley, F. F. Loock, *Allen-Bradley Co.;* J. R. Jeffrey, R. S. Fleshiem, R. O. Gooding, L. W. Grothaus, *Allis-Chalmers Mfg. Co.;* Fred I. Hange, *C. J. Anderson & Co.;* P. C. Clark, L. A. Watson, W. H. Williams, *Clark Controller Co.;* G. A. Burnham, W. S. Edsall, *Condit Electrical Mfg. Corp.;* T. E. Barnum, G. S. Crane, W. C. Stevens, T. D. Montgomery, *Cutler-Hammer, Inc.;* F. R. Fishback, D. C. Wright, *Electric Controller & Mfg. Co.;* Silas McClure, *Electric Machinery Co.;* P. A. Pauly, C. B. Bradish, W. C.

One of the first committees to be appointed by the conference was for the purpose of developing safety standards for industrial control and three of its members were men of the control section of the Electric Power Club, who functioned in conjunction with men associated with the Underwriters' Laboratories, the Workmen's Compensation Service Bureau and the Department of Commerce Bureau of Standards. Safety standards for control equipment were the first developed by the Electrical Safety Conference and these were used as a basis for drawing up other standards.

Probably the most important of these had to do with the proper enclosure of control equipment, particularly with reference to specifying arcing distances, clearance and creepage distances, as well as structural details. Before such standards as these could be definitely fixed it was necessary that manufacturers conduct extensive tests and these have proved of inestimable value.

Industrial Control Standards

George A. Burnham F. R. Fishback

This and subsequent articles to be published in Electrical Manufacturing will discuss the subject of industrial control apparatus and Nema's control standards

Dawson J. Burns E. F. LeNoir Charles R. Durling

Anthony Pinto E. B. Newill J. R. Jeffrey

Control Section of Nema

Yates, L. F. Adams, *General Electric Co.;* F. W. Magin, R. G. Kellogg, H. L. Van Valkenburg, *Industrial Controller Co.;* E. Swift Newton, *I. T. E. Circuit Breaker Co.;* Charles R. Durling, Joseph F. Frese, *Monitor Controller Co.;* L. A. Peterson, Anthony Pinto, *Otis Elevator Co.;* J. S. Rowan, *Rowan Controller Co.;* T. J. Kauffman, J. A. Widmer, *Square D Co.;* William Deans, *Sundh Electric Co., Inc.;* F. T. Wheeler, *Trumbull Electric Mfg. Co.;* Eugene F. LeNoir, *Union Electric Mfg. Co.;* D. J. Burns, *Ward Leonard Electric Co.;* H. D. James, E. B. Newill, *Westinghouse Electric & Mfg. Co.*

Later, when the National Electrical Safety Code was revised members of the control section assisted in the work and all of the material in the control standards of the Electrical Safety Conference was embodied in part three of the revised addition. This code is now in the hands of the American Standards Association, which was formerly the American Engineering Standards Committee, and should shortly be adopted as American Standard.

Aside from these activities the control section has also been functioning in conjunction with the Underwriters' Laboratories in working out a clear-cut specification for judging control equipment. This standard was approved several years ago by the Underwriters' Laboratories and in it are embodied many of the important items in the technical safety standards previously drawn.

Representatives of the control section have also been active on the committees of the National Electrical Code, issued by the National Fire Protection Association. Recently a number of changes have been made in this code which materially simplify the installation rules.

Members of the control section were also active in having the proper committee approve a wiring table similar to that in the Chicago code. This wiring table was adopted recently and will be included in the revised addition of the National Electrical Code. This action represents a very considerable accomplishment that will be of assistance to all users of motors and control apparatus. When it is finally adopted by the American Standards Association it will represent one more step in unifying American practice.

These three standards form very complete specifications and rules for the design, acceptance and installation of control apparatus and it is the hope of the control section that they will be so thoroughly and nationally advertised and specified in this country that they will preclude the use of foreign equipment.

The control section was the first to recognize the importance of issuing rules for the installation and maintenance of its equipment. For some time it had been the practice of each manufacturer to issue his own instructions. These were sometimes in conflict, and some important requirements were often objected to by customers who stated that other manufacturers did not insist on such requirements. It was evident that if all manufacturers joined in a common set of instructions, such criticism would be avoided and a more wholesome influence would be exerted on the trade.

This book of instructions includes in addition to Nema standards, the technical and safety standards, the Underwriters' rules for judging control equipment and the installation rules applying to control in the National Electrical Code issued by the National Fire Protection Association.

The control section has written into its standards items which represent commercial standardization, and therefore, are not included in any joint standard. These items are being added to from time to time, as all standards are subject to change, and require continuous effort to keep them up to date.

"Type Standardization" is the latest effort of the con-

trol section. The program contemplates emphasizing the types, sizes and ratings which present the best economic and engineering advantages. In control engineering, many combinations of units may be made which are practically equivalent. It is therefore desirable to reduce the number of combinations listed or cataloged so far as possible. Unusual circumstances may require special combinations and in such cases, these will be furnished. This is a new departure in standards and promises much for the future. It is gradually being developed as each different line of apparatus is carefully studied and a decision must be arrived at on the essential features, which should be included in such a standard. This work may represent one of the major activities of the control section.

Control section representatives also assisted in having the National Fire Protection Association Standards for Fire Pump Control modified so that they now can be met more easily. This work was carried on by a joint committee with the National Fire Protection Association.

Members of the control section have cooperated with other sections of Nema, particularly the motor section in its relations with outside bodies. At present they are interested in the rules of the N. E. L. A. for the starting current of induction motors. They are also following other activities of this organization through the proper representatives. A number of problems are arising in connection with new systems of distribution which will require close watch and probably new standards for control to meet changed conditions.

Other Accomplishments of Control Section

REPRESENTATIVES of this section have assisted the proper committees in establishing uniform standards in states and municipalities. Many of the rules have been written in the safety standards of the States of Wisconsin and California.

When Chicago was considering special requirements in the design of control apparatus, arrangements were made for a committee from this section to meet with representatives from Chicago to discuss their requirements. The results of this conference were entirely satisfactory and the special requirements were withdrawn.

By far the greatest accomplishment of the control section has been in establishing confidence between its members and the willingness of every member to cooperate for the good of the control industry. In no case has a representative of control failed to secure reasonable consideration where protests have been made. In no case has an individual member company furnished apparatus, or even agreed to furnish apparatus, which weakened the position taken by the section as a whole. It has been able to present a uniform and solid front to all opposition and has been able to make good on all promises of cooperation with the result that this section has built up an influence and standing with outside organizations which now make it easy for its representatives to obtain a hearing and secure agreement on matters which are under controversy. The leaders of other organizations voluntarily come to it for advice and assistance on control questions. It is this influence, enjoyed by all sections, that has built up the reputation of the Manufacturers' Association.

Nema's control standards are published in a handbook and according to the foreword in the booklet, "The Nema handbook on industrial control standards is a reference work of practical information concerning the manufacture, test and performance of industrial control equipment. This book, representing as it does standardized practices in the United States, assists in harmonizing practices in the industry, promotes production economies, and consequently benefits users of electric motors and control equipment.

"Nema—the National Electrical Manufacturers Association was formed by the merger of the Associated Manufacturers of Electrical Supplies and the Electric Power Club. It takes the place in the industry of these two named organization and of the Electrical Manufacturers Council, the oldest of which was organized in 1908.

"Nema Standards and Practices represent the result of many years' research and investigation by this organization, its predecessors, their Sections and Committees. Some of the standards have been approved as American Standard by the American Standards Association, and are so indicated. The standardization thus effected has resulted in greater uniformity in engineering and manufacturing practice and in improved quality of industrial control equipment.

"In the preparation of these standards advantage has been taken of the work of other organizations striving toward helpful standardization, and due credit is given to all organizations whose standards have been helpful in any way.

"The member companies, composing the Industrial Control Section of Nema, are listed in the back of the book. These companies manufacture the great preponderance of the industrial control equipment produced in the United States of America."

The handbook consists of thirty-one pages devoted entirely to the standards, and these thirty-one pages are subdivided under sixteen different heads; namely, Service Conditions, Miscellaneous Definitions, Kinds of Protection, Relays, Qualifying Terms of Relays, Properties and Characteristics of Control Apparatus, Duty and Service Classifications, Rating, Performance and Test, Dielectric Tests, Other Tests, Manufacturers Specifications, Type Standardization, Symbols, Abbreviations, Specifications for D. C. Crane Controllers, and Specifications for Building Equipment Control Apparatus.

Under the heading of Definitions of Standards it is stated that, "The American Standards Association has approved as American Standard certain definitions and rules which were presented to it by the National Electrical Manufacturers Association, either as sole sponsors or as joint sponsor with other organizations. These standards are published herein, together with standards of the National Electrical Manufacturers Association, which have not yet been presented for adoption as American Standard. Those standards which have been approved as American Standard are so designated.

"Any standard adopted by the National Electrical Manufacturers Association as a definite standard or as a definite limit shall be known as National Electrical Manufacturers Association "Adopted Standard."

"An Adopted Standard of the National Electrical Manufacturers Association defines a practice or construction to the observance of which in the interest of the public all members of the Association should adhere, and in no event should a member of the Association represent as standard any product falling below such standard.

"It is distinctly understood that adopted standards relate only to products commercially standardized and subject to repetitive manufacture, and do not apply to products built to meet the special requirements of individual customers."

With respect to recommended practice the definitions of the various standards state that, "Any suggestion or practice which it may be impracticable at the time to recognize as an Adopted Standard, but which it is desirable to recommend as uniform practice, shall be approved and known as a National Electrical Manufacturers Association 'Recommended Practice.'

"A Recommended Practice of the National Electrical Manufacturers Association defines a practice or construction which in the interest of uniformity of procedure is favored by a majority of the members of the interested Divisions or Sections."

It Pays to—

Play a Square Game
Stick to Your Own Industry
Use Established Distribution Channels

When You Are Marketing a New Product

Another marketing article by
JOHN ALLEN MURPHY
Marketing Counsellor

THE mere bringing out and marketing of another item may seem like a simple matter. Actually, however, it is usually such a troublesome question that manufacturers often hold up improvements for years rather than submit themselves to the terrific harassments of putting the improved device on the market.

Electrical manufacturers are reputed to be grave offenders in this respect. I have frequently heard it said that they hold valuable devices in their vaults, long after they have been perfected. For instance, it has been asserted that A. C. radio sets could have been introduced at least a year before they were. I, personally, am familiar with nearly a score of electrical articles that apparently are practicable, but their owners have never made any attempt to offer them to the trade or develop them for the future.

Not so long ago, conditions in the electrical industry were stabilized better than they are today. Then, if a manufacturer brought out a new product, he was reasonably certain to have two or three years to put it over. Now, with goods moving so rapidly, the manufacturer must step lively or he will find his product has grown stale

The electrical industry is not selfishly dilatory in offering improvements. It hesitates to introduce certain new things for the same reason that Henry Ford hated to discard Model T. He knew for years that the Lizzie was passé, but he also knew that to put a refined and educated sister in her place would probably cost his company a cool hundred million smacks. New machinery, dies, retooling, etc., cost Ford fifteen million dollars. The profits lost during the nearly-a-year shutdown would easily extend the expense of introducing the new Ford beyond the hundred million dollar mark.

Introducing New Models Is Expensive

AND Ford's case is not unusual. Ford's new model cost him proportionately no more than it costs an electrical washing machine manufacturer, a vacuum cleaner manufacturer, or any other quantity-production manufacturer to bring out a revised model. Any producer, whether he makes an electrical curling tong or an electrical crane, has to face a heavy loss, if it is necessary for him to shut down to get his new model under way. Stopping production so violently disrupts the normal flow of business that most manufacturers would do almost anything rather than close their factories. Not only does a shut-down throw workers out of employment, but what is even worse, it upsets the market, alienates distributors and lets the barriers down to competitors. There are cases on record where manufacturers have never recovered from a new-model experience.

That is only one of the problems that the launching of a new product will precipitate on the manufacturer. There are others—perhaps not so costly, but almost as serious. If the introduction is intended to replace an old product he must dispose of the old stock that is scattered through the channels of distribution. If there is a large quantity of these goods in the hands of the retailer, the manufacturer should not be expected to absorb them. Neither can he expect his dealers to scrap the old article and to assume the loss.

The New Product Marketing Problem

IF a manufacturer is merely making an addition to his line, without any intention of having the new number take the place of an old product, it must be decided what relationship the baby will have to the rest of the family. Will he be a full-fledged brother or will he be regarded as an adopted waif? Will he be marketed under the family's trade-mark or will it sail under its own cognomen? Will it be packaged as the family is? Will it be given a free advertising ride on the family bus or will it have to pay its own way? Numerous questions of this sort will have to be answered before the baby is qualified to face the world.

This subject is of vital moment to the electrical manufacturer right now. The time was, not so long ago, when conditions in the electrical industry were stabilized better than they are today. Then, if a manufacturer brought out a new product, he was reasonably certain that he would have two or three years to put it over. But now, with new goods moving into the market with about the speed that a projection machine throws motion pictures on a screen, the manufacturer must step lively or he will presently find his product among the "run" films. Since Fashion has become the Mussolini of business, any particular model of a new product may have a brief life. To keep his line in favor, therefore, a manufacturer cannot afford to let his models grow stale. Since this is the situation, an

electrical manufacturer is likely to have the problem of introducing a new model on his hands most of the time.

What is the best way for such a manufacturer to tackle the job? Fortunately, a number of concerns have recently brought out electrical products and we can profit by their experience. The development of the electrical power radio set upset the market of a number of radio accessory manufacturers. Among these are the battery concerns. While the A. C. sets have not yet made much of a dent in the battery sets, still it is recognized that in a few years the A. C. sets will have gained the ascendancy wherever electrical power is available. There will always be a nice battery business in unwired sections of the country and also among people who prefer the battery set.

Play the Rules of the Game

NEVERTHELESS, such wide-awake concerns as the National Carbon Company and the Philco Company were not content to let their radio sales taper off in this way. Having had several years of radio prosperity, they did not propose to surrender this market without a fight. They knew it would be futile to oppose this new vogue in radio. Instead, they decided not only to accept it but to go into the manufacture of radio sets, themselves, and at the same time to retain whatever battery business that remained. Hence, both the National Carbon Company and the Philco Company are now full-fledged radio set manufacturers.

The producers of eliminators, and other accessories that were used in connection with battery radio sets found themselves up against exactly the same problem that confronted the battery people, themselves—a rapid diminution of their radio market. At least two manufacturers in this position also have gone in for the production of sets. These two companies are the Grigsby-Grunow Company and the Fansteel Products Company. The latter concern is better known as the Balkite Company. In fact, a separate organization, known as the Balkite Company, has recently been incorporated to handle the radio end of Fansteel's business.

These four large companies faced the typical new-product marketing problem. They were bringing out an electrical line of a sort that they had never made before. However, they were not strangers to the industry, as they had been selling to the radio market for several years.

The principal point for a manufacturer to observe, in a case of this kind, is to play the rules of the game. Certain peculiar distributing channels have been worked out in the radio trade. Experience has demonstrated that it is best for a radio manufacturer to use these established facilities and not to attempt to blaze new trails in the development and marketing of a new product.

All four concerns that I mentioned knew the rules of the market they were entering. They have played the game to the extent of their respective abilities. The success they have since achieved has varied in proportion to the zest, skill and knowledge that they have put into the play.

The statement that a manufacturer should know the fundamentals of the game that he is about to play may seem trite. But it is not. Almost every day manufacturers bring out electrical devices and in marketing them they fly in the face of experience and violate every sound principle that has been built up by time and by the trial and error system.

A MANUFACTURER should know the rules of the game he is playing and play it square. Almost every day manufacturers bring out products and in marketing them they fly in the face of experience and violate every sound principle that has been built up by time and by the trial and error system. Another element that a manufacturer should observe when he adds a new product to his line is that it is best to stick to the industry with which he has been identified

For example, the best and easiest initial market for many new electric articles is the hotel field. Electrically-driven food-preparing machines may be useful in the home, but they are used in larger quantities in hotels, hospitals and institutions than they are in the household. Selling devices of this sort to the public is a slow, tedious and expensive process. Few manufacturers have either the time or money to engage in a long, introductory campaign. The institutional market is relatively simple. It is concentrated in a comparatively few units. It can be reached quickly and economically. It can be made to pay for itself almost from the beginning. Many an electrical manufacturer has entrenched himself with the institutions before he attempted to sell to the public at all. Then he used the money he thus gained to finance his campaign in the selling of his product in the home.

Other manufacturers have seen the vision of going after the institutional market at the outset, but they tackled it from the wrong angle. For the most part, the institutional field has its own distributing channels. The manufacturer who wishes to cultivate this market will find it advisable to use the channels through which institutional buyers prefer to be sold.

Another element that a manufacturer should observe when he adds a new product to his line is that it is best to stick to the type of business with which he has been identified. If the General Electric Company started a chain of meat markets, everyone would know that this most efficiently managed corporation had at last "pulled a boner." Its chances of making good in the meat business would be remote, because it is a line of trade that is entirely removed from General Electric's basic field—electrical machinery, motors, apparatus, materials and devices.

On the other hand, when the General Electric Company announced that it entered the electric refrigeration game, everyone sat up and took notice. It was immediately taken for granted that any refrigerator General Electric sponsored would be up among the leaders of the industry. In the first hypothetical case, General Electric would have strayed from its field. In the second case, which actually happened, General Electric remained within the field which it knows so well.

A queer thing about most manufacturers, however, is that they often become enamored with the other fellow's business. Distant pastures look the greenest to them. So, when, for one reason or another, they decide to go into some other line or to bring out another product, they frequently select a type of business about which they know little or nothing.

Success Depends on Expert Proficiency

ELECTRIC refrigerators, curiously enough, have been the subject of much of this infatuation. Hundreds of manufacturers, in almost every line on earth, have planned to go in for refrigerators. Fortunately, for themselves, most of these concerns never got beyond the discussion stage. The electric range is another product that seems to appeal to many companies that have no experience in the stove business and, hence, have no knowledge of the difficulties to be encountered in marketing this particular article. And, of course, everyone from dog biscuit manufacturers to the fellow whose only experience in the air has been as a political orator, has been bitten by the aircraft bug. Obviously, with a radically new type of product that has been

in existence for only a few years, such as the aeroplane is, there can be but a very few manufacturers who have had experience directly in this field. Nevertheless, some concerns are better equipped than others to tackle aeroplane manufacture.

The radio business is probably the most striking example of the value to a manufacturer of previous experience in a similar field. In the last ten years thousands of companies have made at least an attempt to break into radio. A large percentage of them succeeded in bringing out some sort of a radio product. Most of them were eventually eliminated, however. It is highly significant that the survivors in nearly every case had previously been engaged in the production of electrical goods or some closely allied merchandise.

This fact was not due to an accident, either. It takes a lifetime to acquire expert proficiency in any specialty and without such proficiency a manufacturer cannot achieve marked success in his chosen field of endeavor. A man cannot be a grocer for a couple of years, then become a druggist, later take up plumbing, then try undertaking and wind up by being an electrician, and get anywhere in his life. Neither can a manufacturer jump all over the map and accomplish anything.

Probably the best explanation of the achievements of the National Carbon Company is, that while it has introduced a big variety of articles, it has never allowed itself to get very far from its basic product—carbon. As I have already related, even the making of radio sets is not a departure for this company. It has merely taken a logical, evolutionary step forward.

Also, when this company recently introduced its Eveready Sunshine lamp, it stuck to its knitting. The lamp burns carbons and it is operated by electricity. In the introduction of an article of this sort, experience in the industry tells from the selection of the raw material to the selection of the distributing outlets. The Sunshine lamp is sold principally by electric light companies, electrical merchandise shops and physicians' supply houses. These particular outlets were chosen because they are in the best position to give this new Eveready product strong selling support.

The Atwater Kent Manufacturing Company is another concern that has frequently changed its product. At the same time, the concern has always remained an electrical manufacturer. Mr. Kent picked on electricity early in life. His father, Prentiss J. Kent, was a physician. All physicians of that period kept a set of old-fashioned batteries as part of their equipment. It was his father's magnetic batteries that first aroused his interest in electricity.

The Influence of Environment

THE experience that young Kent gained in fussing with these batteries inspired him, a few years later, to build a motor for operating an electrical fan. This was followed by the construction of a motor propeller, which was attached to a canoe. Accidentally he stumbled on the same principle that is today used in the manufacture of the popular outboard motor for row boats.

When he went to college, Atwater Kent continued his interest in electricity, taking an electrical engineering course. Even as a college student, he could not keep away from outside experiments. Every moment he could spare from his studies was spent in experimenting with batteries and motors and interior telephone sets, etc. He even operated a sort of amateur manufacturing business at college, which succeeded to the extent of producing a little revenue.

When he finished college, his first job was with a manufacturer of electric motors. His second position was as a traveling salesman of motors. His third step was to start his own manufacturing business in Philadelphia. I cite all this detail about Mr. Kent's early experience to show how a person's youthful interests, the pursuit of his hobbies, his education, his environment, his first jobs, all have a deciding influence not only on his subsequent career, but also on the very type of business that he elects to enter.

Evolution of Demand Cause of Changes

THE Atwater Kent Manufacturing Company's first product was interior telephone systems and small voltmeters. Its present product is radio receiving sets. What a wide detour it has taken! And yet, essentially, the company is still on the same road. In fact, it was the making of telephone systems originally that ultimately led the concern into the radio business.

It really is a matter of little importance what product a manufacturer starts out with, so long as he has a natural liking for that type of business, and there is a promise of a market for the thing he intends to make. Regardless of what his initial product is, the chances are that the evolution of demand will have swept him along into a business that differs appreciably from the one he originated.

THE RADIO business is probably the most striking example of the value to a manufacturer of previous experience in a similar field. In the last ten years thousands of companies have made at least an attempt to break into radio. A large number succeeded in bringing out some sort of radio product. It is highly significant to note that the survivors in nearly every case had previously been engaged in the manufacture of electrical goods or some closely allied merchandise

Mr. Kent started his business in 1902. He made radical changes in the character of his product every four or five years, although continuing essentially as an electrical manufacturer. By 1910, evolution had gone so far that Kent was then manufacturing automobile ignition systems exclusively. This system included the Unisparker, which Mr. Kent invented.

The next step in the progress of the Kent business came as a result of the decline of the carbide gas method of lighting cars. Carbide gas gave way to electricity. The Atwater Kent Manufacturing Company decided that electric light systems for automobiles would be a logical line to add to its starting business. The company was in the throes of getting acquainted with this new baby, when the war started. Uncle Sam thought the factory was ideal for making certain war equipment. So he set them to work turning out fuse setters, clinometers, panoramic sights for machine guns, etc.

But even war work did not throw the Kent business out of the line of evolution in which it had run from the first. Its initial product was an article of delicate construction. Each time a new device was added, it was invariably something of a precision nature. The work for the Government was of this same type.

When the little trouble in Europe had been concluded, the company resumed its starting and lighting business. A year or two afterwards, a letter was received from a manufacturer asking if the company was in position to make ten thousand head-phones for radio receivers. Undoubtedly the writer of the letter thought that Kent was still in the interior telephone business and that the making of head-phones would be an easy thing for the factory to turn out. Of course, the company could have handled this order and probably would have done so had not another idea struck Mr. Kent. He said to an associate, "If the

(*Continued on page 67*)

SPAIN—a Market for

With its hydroelectric developments well under way, and seventy-five per cent of its homes already electrified, Spain is an excellent market for exports

By FRANCISCO BRUALLA
Editor, ELECTRICIDAD EN AMERICA

SPAIN is a country awakened. From the days of romance when anything Spanish was the symbol for blissful leisure, Spain is rapidly taking its place among the progressive industrial nations of the world. So quietly is the transformation being effected that little of this great activity has become generally known in the United States.

American industrial leaders and manufacturers with few exceptions have entirely neglected this fertile market. Although Spain could be comfortably placed in the State of Texas with 70,000 square miles to spare, there is abundant wealth within her boundaries both in natural resources and gold. Spain, a good many people will be surprised to learn, is the third wealthiest of nations.

Although a native of Spain, I had been away from my mother country for a number of years. I had heard of this change in the order of things through my business contacts but little did I realize the extent of this vast progressive movement until I had arrived on Spanish territory from France.

I was at once impressed with the activity and confidence that is noticeable everywhere. To me Spain resembled a vast workshop. People were working, spending money and looked happy. One cannot help compare present-day conditions with those existing not so many years ago. Today agriculture, industry and commerce are in an exceedingly prosperous state and absolute confidence exists that this condition will continue.

Spain, as you probably know, was once chiefly an agricultural country depending to a large extent on natural resources and products taken from the land. Today it is rapidly becoming industrialized although the chief agricultural activities are not being neglected by any means.

These changes have come about through the following factors: lack of demand for exportable surplus of agricultural products; governmental progressiveness; a desire to utilize dormant capital for the development of resources and industry; development of great natural water-power resources in the generation of electrical energy and irrigation.

My visit included the chief industrial and electrical centers, to wit: Barcelona, Madrid, San Sebastian and Bilbao. The development mentioned is not confined to these centers by any means but apply to the whole country. The electrical industry was, of course, my chief concern, and I found it exceptionally well prepared to do its share in the development program.

From personal inspection and from interviews with central station officials, importers, dealers, and contractors, I found that the market for electrical supplies, appliances and equipment, is now unusually good and with every prospect of its becoming better in the very near future.

Hydro-electric Map of Spain

To develop the hydro-electric power of Spain progressively, the country has been divided into seven regions. In each the power to be developed is indicated on the map. These developments will permit the irrigation of vast areas of fertile land, creating great wealth and giving a solid basis for the economical, industrial and social growth of Spain. Work was started in the Ebro region two years ago, and development of the other regions will follow. It is estimated by the engineers that ten years will be required to complete the work. Hydro-electric confederations have been formed in each region

Electrical Products

ELECTRICAL MANUFACTURERS who plan to enter the export business have many problems confronting them, and in order that they may know what some of them are ELECTRICAL MANUFACTURING publishes from time to time information on this subject. One article by Dorothy Dignam, in the December, 1928, issue, discussed the appliance demand in England, while that accompanying treats of conditions in Spain and its possibilities as a market for American-made electrical merchandise

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About two years ago the results of a survey were published which showed that 75 per cent of the homes in Spain were electrically lighted, while in the United States only 53 per cent of the homes were so lighted. This is the best evidence of the electrical progress of the country. It is true that household appliances have not come into such general use as in the United States, but this condition is rapidly being rectified as the mounting sale of appliances shows. Electricity is the cheapest way to have light and heat in Spain, which in itself is the best reason for the widespread use of electricity for all purposes.

In the last few years there has been a great demand for electricity for power and heat in industrial plants. The textile factories in Catalonia, as well as steel factories, machine shops, mines, mills, and the like, everywhere have been electrified, substituting electricity for steam engine and boiler power plants, through transformers and substations, where they receive high voltage current.

To supply this demand and anticipating future growth, the electric power companies have been increasing their output year after year and there are several very large hydroelectric power plants in construction. Spain has a very extensive program of water power development, which has already been started and which will add several hundred thousand horsepower to the power resources of the country. Some of this power will be used for steam railroad electrification.

As part of this program, a hydroelectric plant is being built in the Saltos de Alberche (Alberche Falls), near Madrid. This development will be completed in 1929 and,

Francisco Brualla

besides supplying all the electric power for the railroad electrification in the section between Madrid and Segovia, will leave an estimated surplus of 400,000,000 kilowatt-hours a year, which will have to be absorbed by the industries and lighting. The manager of the commercial department of the Co-operativa Electra Madrid, the company which will distribute this power surplus, said to the writer that they will do everything to encourage the use of appliances, better lighting in stores, factories, offices and homes. It means that the Madrid section is going to be a splendid market for all kinds of electrical appliances, motors, lighting fixtures, and so forth.

A night view of the Cataluna Square in Barcelona, the most important industrial center in Spain. It is a modern cosmopolitan city in every respect

A very similar situation is found in Barcelona. The companies giving electric service in that city and in all the Catalonian region find themselves with an increased production through the development of several water sites and are faced also with the problem of disposing of this power. The Compania Barcelonesa de Electricidad, one of the distributing companies of Barcelona, together with the Energia Electrica de Cataluna, both subsidiaries of Riegos y Fureza del Ebro, have completed plans to take care of this increased power. They began last year a series of advertising and selling campaigns. Their first campaign featured domestic refrigerators. Because the season was quite advanced the campaign was very

short; the expenditures for direct mail advertising and periodical advertising amounting only to $700. They expected to sell only fifty or sixty refrigerators, but they were surprised when at the end of the campaign it was found that the two or three dealers selling domestic refrigerators in Barcelona had sold 300 of them. The average sale was 1800 pesetas, or $288. In the first campaign of 1929 the feature will be vacuum cleaners. The goal is to sell, during 1929, 25,000 vacuum cleaners in the city of Barcelona alone, and over 60,000 in all the territory served by these companies. There is confidence that this goal will be reached. To carry out the campaign the companies have organized a publicity department on the same lines of American utilities. It should be understood that the companies themselves do not sell appliances, but maintain exhibition rooms where the dealers can send the appliances they sell to be exhibited and demonstrated. The companies conduct regular demonstrations of all appliances for the benefit of the public.

In the industrial and commercial fields, the Barcelona utilities are also very active. They have organized an engineering department for promoting applications of electric heat to industrial processes and an illuminating engineering department to promote proper lighting in stores, streets, factories, offices, homes and public buildings.

Furthermore, having in mind the success of installment buying in the United States, the electric utilities, together with the more responsible dealers and contractors, have made arrangements with a banking house for the financing of an installment plan for appliances in home, store and factory installations, on the basis of a small down-payment and three years to pay the balance, in monthly installments.

A street scene in the shopping district of Barcelona at night. All street lighting is of the most modern type and is remotely controlled

Installment selling is quite common in Spain for other lines and it seems that the percentage of loss is very small. Payments are extended to three years to further influence the buying.

Spain is practically electrified as far as lighting is concerned but there is much room for the introduction of newer methods and equipment.

In order to come to a better understanding of the situation, let me pass over the electrical development in Spain during the last forty or fifty years. Spain has been gifted by nature with many waterfalls, small and large. These waterfalls have been used for a great many years as a source of power all over Spain. Originally and even today, many of the smallest falls are used to drive the stone in flour mills and even the smallest hamlet or village had one, two, or three of these mills, to which the inhabitants took their wheat to be converted into flour. An enterprising man would buy the water rights from the millers and would install a cylinder flour mill, driving the machinery by a waterwheel. He would have a surplus of power and would install a dynamo to supply light to the streets and homes of the village. The writer remembers such an installation made not less than forty years ago, and in this way almost every village, no matter how small it is, is electrically lighted in Spain. It is the cheapest way to have light. Later on, hydroelectric plants were built to supply the larger cities and many small villages. Again an enterprising man would make arrangements with the electric light company and operate a substation to supply the electric energy for power and light to the village. There are a great many substations of this kind, but the service given is very limited. The application of lighting in homes and streets is poor, only in medium and large cities is the service good and in some excellent.

There is plenty of business to be had in promoting better lighting in stores. Particularly the show window lighting, and the interior of the stores. I am convinced that better lighting campaigns would have great success; the only thing necessary is for some expert to show the way. The same applies to homes, factories, and offices. In theaters and cafés the lighting is ample but glaring. Right here is an interesting and profitable job for someone to show the theaters and café owners how to get better service from the money they spend in superfluous light.

The sale of electrical appliances in Spain has been limited up to now. Some have been sold but there has been no serious effort on the part of the electric utilities and dealers to popularize them. I have seen very few appliances of American manufacture. The cheap German products predominate but the sale is limited. It seems that they have not succeeded in creating confidence in their safe use and the women are afraid to use them. I was told that it would be possible to sell thousands of electric irons if they had a reliable one on the market which could be recommended, but there is none.

American electrical appliances would have a good market in spite of the fact that they are higher priced, because they are good and safe, if only manufacturers would secure distributors and give them support and cooperation. It is not enough to send them a few catalogs and circulars, grant them a discount and let them get orders. Something more is necessary. Above all, they need assistance in merchandising.

The sale of house appliances is a matter of education. We know that by experience in this country, and unless the manufacturers make up their minds to use methods similar to the ones used here, the sale of appliances in foreign markets will progress very slowly. The Spanish people respond to well-directed advertising as readily as the American people. This has been proved by the results of the Barcelona refrigerator campaign.

Up to now the utilities have not shown much interest in the appliance selling proposition, their main interest being to put electric light in all the homes. This they have accomplished and now they are ready to promote the sale of appliances. I have already explained how they started their campaigns.

By far, the industrial field is at present the most promising market for American products. The industrial development of Spain has been very great since the war, but particularly so in the last seven years. The old industries are being modernized. Electrically-driven machinery and

(*Continued on page 72*)

The Fundamental Theory of Capacitor Motors

This type of motor has a wide field of application and its performance is good with respect to efficiency, power factor, starting current and torques

By H. C. Specht*

Electrical Egineer, Westinghouse Electric & Manufacturing Company

An ordinary two-phase motor may be used as a capacitor motor, one phase being connected directly, and the other in series with a condenser, to a single-phase circuit. The performance, however, may not be all that is desired. The hp. rating, especially, may have to be reduced from its normal two-phase value, in order to obtain sufficient relative pull-out torque. By varying the capacitor continuously as the load changes, operating characteristics approximating those of the two-phase motor could be obtained. This, however, is not pracical, and only one or two taps from the capacitor are permissible, generaly one for the starting and one for the running load.

The capacitor motor could be designed with a power factor of nearly 100 per cent and an efficiency nearly equai to a similarly rated two-phase motor. However, in order to obtain a smaller capacitor, a reasonable sacrifice in power and efficiency may be accepted.

In order to have a clear understanding of the various characteristics of the capacitor motor it may be well to deal first with the general theory of a capacitor motor, assuming the stator to be wound two phase and the windings spaced 90 electrical degrees apart.

The fundamental equation of starting torque for any kind of an electrical motor is as follows:

Starting torque = Rotor ampere turns × flux × cosine of the angle between their vectors × a constant.

Φ_1 = Flux of main phase.
Φ_c = Flux of condenser phase.
i_1 = Stator amperes in main phase.
i_{1c} = Stator amperes in condenser phase.
i_2' = Current in the rotor of main phase and reduced to stator winding turns.
i_{2c}' = Current in rotor of condenser phase and reduced to stator winding turns.
$e_1 = e_2'$ = Rotor voltage induced by Φ_1, and reduced to stator winding turns.
$e_{1c} = e_{2c}'$ = Rotor voltage induced by Φ_c and reduced to stator winding turns.
E = Line voltage.
E_c = Terminal voltage of the capacitor phase.
e_c = Capacitor voltage.
t_1 = Stator winding turns in main phase.
t_{1c} = Stator winding turns in capacitor phase.
k_1 & k_2 = Main phase winding distribution factors.
k_{1c} & k_{2c} = Capacitor phase winding distribution factors.
f = Line frequency.
s = Slip.
p = Number of poles.
C = Capacity microfarads.
r_1 = Resistance in ohms of stator main phase.
r_{1c} = Resistance in ohms of stator winding in capacitor phase.
r_2' = Ohmic resistance of rotor reduced to main phase winding turns.
r_{2c}' = Resistance in ohms of rotor reduced to stator condenser phase winding turns.
x_1, x_{1c}, x_2' and x_{2c}' = The corresponding leakage reactances.
$x = \frac{10_c}{2\ \omega f C}$ Capacitance in ohms.
Ψ_1 = Angle between i_2' and Φ_c.
Ψ_2 = Angle between i_{2c}' and Φ_1.
α = Angle between Φ_1 and Φ_c.
T_1 = Torque in $k\ g\ m$ developed by main phase.
T_2 = Torque in $k\ g\ m$ developed by condenser phase.

$$T_1 = 2.3 \times p \times \Phi_c \times i_2' \times t_1 \times \frac{k_1}{k_2} \times \cos \Psi_1 \times 10^{-10}\ k\ g\ m \quad (1)$$

$$T_2 = 2.3 \times p \times \Phi_1 \times i_{2c}' \times t_{1c} \times \frac{k_{1c}}{k_{2c}} \times \cos \Psi_2 \times 10^{-10}\ k\ g\ m \quad (2)$$

$T_1 + T_2$ = Total starting torque.

If the windings of the two phases have equal amounts of copper the formula for torque may be written as follows:

$$T = \frac{e_2' \times e_{2c}'}{2\ \pi f} \times p \times \frac{r_2'}{(r_2')^2 + (x_2')^2} \times \sin\ \alpha \times 10^{-9} \times \text{Const.} \quad (3)$$

* Abstracted from a paper presented at the winter convention of the American Institute of Electrical Engineers in New York.

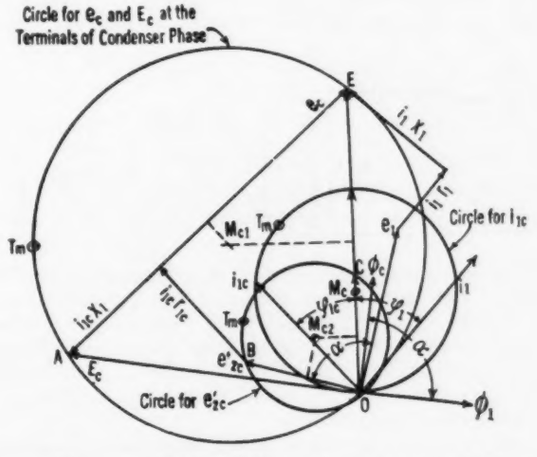


Figure 1. Vector diagram of motor at standstill

From this formula it follows that the maximum starting torque for different rotor resistances occurs when $r_2' = x_2'$ providing all other values remain the same. The induced voltage in the rotor depends on the stator impedance drop and in the capacitor phase also on the capacity. As the induced voltage varies the torque changes proportionately. Further, the torque depends on the angle α and this, for maximum starting torque, should be close to 90 deg. When figuring the torque it is convenient to use the graphical method as this gives a clear picture and helps in making changes necessary to obtain the best results. First of all the currents and their power factors are figured.

$$i_1 = \frac{E}{\sqrt{(r_1 + r_2')^2 + (x_1 + x_2')_2}} \quad (4)$$

$$\cos \varphi_1 = \frac{r_1 + r_2'}{\sqrt{(r_1 + r_2')^2 + (x_1 + x_2')^2}} \quad (5)$$

$$i_{1c} = \frac{E}{\sqrt{(r_{1c} + r_{2c}')^2 + (x_{1c} + x_{2c}' - x_c)^2}} \quad (6)$$

$$\cos \varphi_{1c} = \frac{r_{1c} + r_{2c}'}{\sqrt{(r_{1c} + r_{2c}')^2 + (x_{1c} + x_{2c}' - x_c)^2}} \quad (7)$$

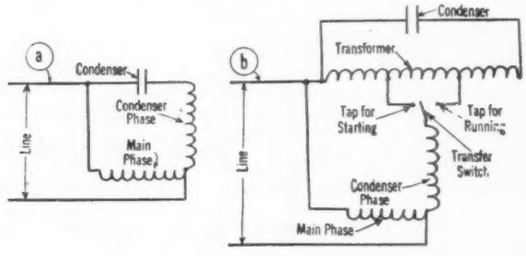


Figure 2. (a) Condenser in series with auxiliary phase. (b) Condenser in parallel with transformer

The other values are obtained from the graphical method. (See Figure 1.)

The locus of the vector e_{1c} is a circle with the diameter of $\frac{E}{r_{1c} + r_{2c}'}$ and its center on the vertical line of $O\ E$. Therefore the locus of the voltage vectors is also a circle, the center M_{c_1} of which is determined by the intersection of the perpendicular erected at the center of $O\ E$ and A.

Also the locus of the vector of the induced voltage in the rotor is a circle and its center M_{c_2} is determined by the intersection of the perpendiculars through the center of $O\ B$ and $O\ C$. $O\ B$ represents the rotor voltage of the capacitor phase at a given capacity and $O\ C$ represents the rotor voltage at resonance. After the circles are determined it is an easy matter to pick from the diagram the voltages for any current because the angularity in regard to the individual vectors must be the same. The maximum starting torque for the various capacities occurs when $\sin \alpha \times e_{2c}' =$ maximum, which is at the point where the tangent at this rotor voltage circle of e_{2c}' is parallel to vector e_1. This point is marked in Figure 1 with T_m, the corresponding point is also indicated on the circle for the condenser voltage E_c and the current i_{1c}. The point T_m on the current circle is the tangent point to i_1 and T_m on the voltage circle E_c and e_c is the tangent point to $O\ E$ or line voltage.

It will be noted from the diagram, that with an appreciably smaller value of current and capacity near the point T_m, the torque is not much smaller. Therefore, in order to keep the starting current as low as possible, it will be advisable to stay below the maximum point.

Since the capacity required to give a starting torque equal to or more than full load torque is so great, the capacitor may cost more than the motor, a series transformer should be used in connection with the condenser. The connection diagram most commonly used is shown in Figure 2.

The advantage of this scheme is indicated very well by the fact that the capacity required decreases inversely with the square of the transformer voltage ratio and that at a certain voltage the cost of the condenser for the same volt-amperes is the lowest. The transformer also makes possible, by means of a transfer switch, the use of different effective capacities for both the starting and running conditions without breaking the condenser circuit. This is highly desirable. This transfer switch may be of the centrifugal type or the magnetically operated type. The magnet coil of the latter type is connected, preferably, in the main winding circuit since the current of this winding varies through a wider range.

Designing the Transformer

IN designing the transformer it should be observed that the magnetizing reactance reduces the effective capacity, and that the watts loss also reduces the over-all motor efficiency. Therefore, the transformer must be of ample size.

Considering starting torque only, it will be the cheapest proposition to work the main phase of the motor heavy and the capacitor phase light. How the value of the starting torque changes with an unbalanced winding system, is illustrated as follows:

Example. The amount of copper in both phases may be assumed as equal. The capacitor phase may, however, have twice as many turns as the main phase and therefore only half the cross section. The ohms resistance and the leakage reactance will be four times, and for simplicity the capacity may be only ¼. Therefore,

$i_{1c} = ¼$ with its power factor remaining the same.

According to formulas (**1**) and (**2**) we find:

$T_1 = ½$ the value of the motor with balanced windings because the flux is half as great.

$T_2 = ½$ the value of the motor with balanced windings as the current is only ¼ as great and winding turns twice as many.

The resultant torque is therefore only decreased ½ while the condenser capacity has been reduced to ¼. The starting current in the line is decreased to 73 per cent of value with balanced windings, providing both current vectors remain 90 deg. apart.

Generally it can be stated that the starting torque decreases approximately in the inverse ratio of the winding turns in the capacitor phase providing the amount of copper in both phases is kept the same and the capacity decreased in the inverse ratio of winding turns squared. If the ratio of the amount of copper in the two phases is changed, the results are certainly different because the induced voltage

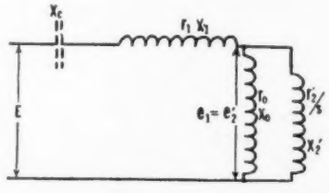


Figure 3. Circuit diagram of motor impedance

in the rotor or the corresponding flux depends on the impedance drop in the stator winding. For commercial reasons, however, it is in some cases permissible to reduce the total copper section of the capacitor phase and still meet the required torques. However, in doing this the change in the performance of the motor under running load must also be given consideration.

When the motor is runnin geach phase will, in addition to its main flux produce due to rotation a flux at right angles to the main flux. This field is a little smaller than

the main field due to the rotor impedance drop. Therefore, for satisfactory operation it is necessary that the flux produced by the main and capacitor phase are at least approximately equal and displaced 90 deg. in time phase. If this is not the case, the rotational voltage produced by the main phase will not be equal to the transformer voltage of the capacitor phase and vice versa. This unbalanced voltage will cause a circulating current of such magnitude as to establish equilibrium. Such circulating currents result in a motor of lower performance and therefore in practise the capacitor motor will be designed with balanced flux condition without circulating current at normal operating load.

Determining the Vector Diagram

ALTHOUGH the method of calculation given in the following is limited in application to the balanced flux condition, it is a short and simple method for getting quick results which are sufficiently accurate for practical use. The impedance of an induction motor may be represented by the well known circuit diagram shown in Figure 3.

In determining the complete vector diagram it is simplest to start out with the induced voltage in the rotor winding. According to the size of the motor the induced rotor voltage is generally from 4 to 8 per cent less than the line voltage. If at the end of the calculation this assumed voltage be found incorrect, the corrections can easily be made.

Since the magnetizing circuit is in parallel with the rotor circuit the corresponding conductance and susceptance must be used in our calculations.

$$i_1 = e_1 \sqrt{(g_0 + g_2)^2 + (b_0 + b_2)^2}$$

$$\cos \alpha_1 = \frac{g_0 + g_2}{\sqrt{(g_0 + g_2)^2 + (b_0 + b_2)^2}}$$

$$g_0 = \frac{r_0}{r_0^2 + x_0^2} \qquad g_2 = \frac{r_2'/s}{(r_2'/s)^2 + x_2'^2}$$

$$b_0 = \frac{x_0}{r_0^2 + x_0^2} \qquad b_2 = \frac{x_2'}{(r_2'/s)^2 + x_2'^2}$$

Having thus determined the value i_1, for both windings, lay off (Figure 4) first the vectors i_{1c} and e_{1c} for the capacitor phase, then add the impedance drop of the stator winding. The vector $O\ A$ then represents the terminal voltage at the capacitor phase winding.

A line from A at right angles to i_{1c} and an arc with a radius equal to the line voltage around the point O as a center will determine the voltage e_c for the capacitor.

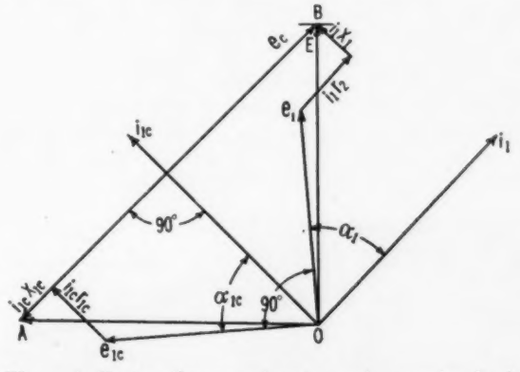


Figure 4. Vector diagram of motor under running load

Then the capacitance in ohms is $\frac{e_c}{i_{1c}}$ and in microfarads it is $\frac{i_{1c} \times 10^6}{2 \times \pi \times f \times e_c}$. If a capacitor with a transformer is used, the impedance drop of the transformer which is in series with the stator winding is also to be added.

The vector e_1 must be nearly equal to and at right angles to e_{1c}. By the angle α_1 the vector i_1 is determined. The stator impedance drop added to e_1 should end again in the point B. If the two windings of the stator are not alike the induced voltage e_{1c} will $= e_1 \times \frac{t_{1c} \times f_{1c}}{t_1 \times f_1}$ where t_1 and t_{1c} represent the corresponding winding turns and f_1 and f_{1c} their winding distribution factors. If the capacity obtained should not give the desired pull-out torque, the windings or the value of microfarads of the capacitor may be changed. It will then be found that the induced voltage e_{1c} in the rotor will change very little as long as the change stays within reasonable limits, because the voltage e_{1c} is governed somewhat by the induced voltage e_1 of the main phase. Certainly the current in the capacitor phase will change almost in ratio with the change of capacity. If the capacity is made considerably greater than a balanced condition would require, the voltage in the capacitor phase will go up, and by its transformer action, will reduce the amperes and watts in the main phase considerably. The watts may even become negative. On the other hand, the capacitor phase will take more load in both current and watts. Naturally the line amperes and watts input will go up, resulting in lower efficiency and correspondingly increased heating of the motor.

Capacitor. As was mentioned before, the capacity required to insure a good capacitor motor is relatively high. The fact that the effective capacity varies with the square of the voltage, makes possible and desirable the use of a series auto transformer, as shown in Figure 2. How far the voltage on the capacitor may be raised economically depends on the cost of the capacitor per kilovolt-ampere capacity and on the cost of the transformer. The cost of the transformer is quite an item in cases where the line voltage is relatively high or where the starting torque required is low, the capacitor unit using a condenser only without a transformer may be more economical. By adding a transformer some of the capacitor effect is sacrificed, due to the magnetizing volt-amperes in the transformer.

Applications of Capacitor Motors

AS far as the electrical performance is concerned, the capacitor motor may be used for almost any class of service where practically constant speed is desired. It has great flexibility of design. On applications where high power factor, high starting torque, and low starting current are required, the capacitor motor finds a good field. The possibility of obtaining various speeds by changing the capacity or, when wound slip ring polyphase rotors are used, of changing the resistance in the rotor circuit, insures the motor a field for such applications as blowers and similar devices. Further, where reversing service or braking is required, the capacitor motor may be used. The possibilities of application of the capacitor motor are so numerous that many pages covering its field could be written.

Following is a summary of the features and characteristics of capacitor motors:

1. The motor has good performance in respect to power factor, efficiency, starting current, and torques.
2. The motor is simple in construction and has no objectionable commutator or brushes. The rotor can be wound either squirrel cage or polyphase with slip rings.
3. The field of application for the capacitor motor is broader and less limited than for any other type of single-phase motor.
4. The unit takes up more space on account of the capacitor.
5. Generally the total unit cost is higher than for any other type of single-phase motor. This is probably the only factor which may react against its present day use.

Display Cartons Assist in Marketing

Merchandise packed in attractive containers, and used by dealers for display purposes affords its maker a valuable opportunity to advertise the product directly to the consumer

THE now generally well recognized practice of packing merchandise in display containers or cartons offers to the manufacturer as many if not more advantages than it does to the middleman or the dealer. First, there is the advertising value of the package, in that it permits of the use of trade marks, trade names and other sales information. Then, too, if the cartons are attractively designed, they lend themselves readily to sales stimulating window and counter displays. And, from the standpoint of protection of the product, merchandise packed in display cartons is not usually subjected to the same amount of handling as that sold in bulk.

Aside from this, substitution of merchandise of inferior quality or other kinds, in place of the original product, is almost entirely prevented, to say nothing of the economies to be derived from ease in handling, storing and transportation. These factors are as essential to the manufacturer as they are to the distributor or the retailer of the merchandise. Goods put up in unit packages, whether for display purposes or not, are more easily handled through production and manufacturing operations by modern types of materials handling equipment than those usually handled and sold in bulk. Packaged goods also require less valuable storage space in manufacturing plants and ordinarily they can be more easily transported. In addition, the unit package makes an inventory unit that is of material aid in accounting and the keeping of inventory records.

There are also the advantages that merchandise packed in display cartons is protected from breakage, spoilage and pilferage, and there is the added insurance that the product will reach the ultimate consumer in the same condition in which it left the factory. Other advantages are to be realized in the standardization of quality and quantity of the product; the promotion of sales in small units of many products heretofore sold only in bulk and the opportunities for maintaining uniform prices.

There are many electrical products that cannot be adapted to packing in display cartons, yet there are many more that can easily be packed in neat and attractive units. Among the latter might be included numerous small devices such as plugs, cord sets, fuses, lamps and other similar merchandise sold for use in the home, as well as a long list of household appliances, including irons, percolators and the like.

Such cartons as are used need not be highly expensive, except possibly, when they are intended as gift packages. Even with these there is a certain amount of advertising value, as the boxes or packages can be ornamental, with printing and decorations in brilliant colors that will attract attention. With all of them, whether they are display cartons or merely unit containers, there is the opportunity for increased sales through the use of package inserts telling of new uses for the product. Usually too, when display cartons are used there is little need for other advertising matter, such as counter or window posters.

THE illustration at the top of this page shows how one electrical manufacturer packages his product in a de luxe gift box. The box is neat in appearance and sufficiently attractive to compel attention. At the right are two more examples of different types of display cartons. One of them is printed in two colors and is used for displaying decorative lighting sets, while the other contains a floor cord, but both of them afford good advertising value to the manufacturer as well as the dealer who uses them

the Electrical Manufacturer *His Products*

"THEY SHOW WHEN THEY BLOW"
TRICO "CLEAR TOP" FUSES
KEEP A SUPPLY AT HAND FOR EMERGENCIES
ANY ONE CAN MAKE REPLACEMENTS WITH PERFECT SAFETY
PORCELAIN TOP - NO SHOCKS
PORCELAIN TOP - NO BURNS
TRICO FUSES
TRICO FUSE

One electrical manufacturer in discussing the subject of display cartons and their advantages says in part, "When we first placed our product on the market it was sold without the carton, and after much consideration we decided that we could increase our sales by placing the merchandise into what we call a de luxe gift package. Not only did we find that we had increased our sales by the use of this type of package but the gift carton enabled us to find new outlets for the product. The cover on the box when open forms an attractive display container and serves as a display card, thus eliminating the necessity for any special advertising matter."

One manufacturer of decorative lighting sets, says, in speaking of his product and the uses of display cartons. "The advantages of having the type of box we use can be summarized as follows: The piece can be used as a counter display showing not only the product, but, in as much as the cover is printed in two colors it attracts attention to the counter. The particular sets we make are placed in cartons that do not have any Christmas decorations on them and we believe this is an advantage, because of the fact that it makes it possible for the dealer to use the product throughout the entire year."

A manufacturer of fuses states that, "Plug fuses are packed in handy cartons of five fuses to the unit package. This method protects the fuses from being damaged or shop worn, and at the same time affords the dealer an opportunity to sell customers the idea of carrying an extra supply by purchasing a full box. The practice heretofore has been to sell the number called for, which was in most cases one or two. Furthermore, printed on the box is information of considerable value to the customer."

Probably one of the first and now the most extensive user of display cartons is the electric lamp manufacturer. When the idea of packing the lamps in cartons was first conceived the box was little more than a means for protecting the lamp against breakage, but, after a time, the advertising value of the carton was realized. Since that time the container has evolved from merely a protection for the lamp into an advertising medium of no little value. Then, the group package, or the carton containing several lamps was developed and from it came the idea that there were advantages in arranging these cartons for display purpose. As has been said, this latter use of cartons has materially increased the sale of lamps, as it will other products of a similar nature.

Radio tube manufacturers have hit upon the same scheme for placing their products before the public until today there is scarcely a tube that is not packed for display and retail sale in some form of decorated carton. As another example of the possibilities of display cartons there is the electric irons that are packed in gift boxes so designed as to make a container for the iron. Such packages as this have their uses as displays and even after the device has been sold the carton is useful in the home, where it still serves as an advertisement.

There are many similar instances that could be pointed out with respect to the uses and advantages of display containers. One that is highly important to the manufacturer is that the dealer will usually place display cartons in conspicuous places on his counters or in his store windows, whereas, products sold in bulk and not packed in containers, are ordinarily stored on shelves or in bins.

AT the left are two more illustrations of display containers. In one is a decorative lighting set similar to that shown on the opposite page, while the other contains an electric phonograph pickup. When merchandise is packaged in this manner the prospective customer is immediately attracted to it, and he can ordinarily see what he is buying without removing the goods from the container, thereby eliminating damage in handling the product

KNOW YOUR *SELLING* COSTS *on* Lighting Equipment

That was the outstanding message delivered at the eighth annual Artistic Lighting Equipment Association convention

LIGHTING equipment manufacturers have made progress in using production cost analysis, but many, in the words of an A. L. E. A. convention speaker, have been enjoying the doubtful luxury of sustaining staggering distribution losses without even questioning them

MANUFACTURERS of lighting equipment must know their selling costs. That was the outstanding message delivered at the eighth annual convention of the Artistic Lighting Equipment Association, held at Cavalier Hotel, Virginia Beach, Norfolk, Va., Feb. 5-8. Speaker after speaker emphasized the fact that, although manufacturing members of the association have made considerable progress in the use of production cost analysis systems, they have been "enjoying," as one speaker put it, the doubtful luxury of sustaining staggering distribution losses without even questioning them.

The point was made that very few lighting equipment manufacturers know, with any degree of accuracy, what their selling costs are. Inefficient and profit-eating distribution, it was shown, was caused by obsolescence, constantly changing styles, too wide a variety of sales outlets and the high and usually unprovided for cost of assisting dealers to make specific sales to consumers—a practice amounting in most cases to retail selling at wholesale rates.

Missionary Work Cost Is High

THE evil of this practice was described as "the high cost of missionary work." Some manufacturers, believing they were giving the customer too much service, felt that they should charge the dealer more if the manufacturer's salesman helped him to make a retail sale. Careful inspection and study of this and all other elements of high distribution costs was emphasized as a vital need.

It was pointed out that cost systems designed to give the manufacturer a complete picture of his production expenses once a month concerned themselves with only half the expenses of his business. It was felt that the same initiative must be shown in ascertaining and reducing distribution costs as several lighting equipment manufacturers have already displayed in using cost analysis to cut production expenses and to gage prices accordingly.

O. E. Moe of Moe-Bridges Company, explaining the reasons why his company adopted the policy of selling through exclusive dealers, said, "We could sell through wholesalers much more economically than through dealers or our own retail outlets, but we couldn't get the same volume. The big problem is to obtain the right kind of merchandising support from the dealer. Too many dealers are merely craftsmen rather than merchandisers."

His company's exclusive dealer selling policy, said Mr. Moe, had been sufficiently successful to warrant its enlargement. It eliminated price competition on the company's lines among several dealers in the same locality. Salesmen had fewer calls to make, and more sales could be made through a single authorized dealer than through a half dozen under the old plan.

Mr. Moe made the interesting point that his company instructed its salesmen that the real value of a fixture was its cost delivered, not its wholesale cost.

Granville P. Rogers, managing director of the A. L. E. A., reported that its collection department had already collected $213,153, or more than 60 per cent of the claims filed by manufacturing members, and at no cost to them. In the two months of its existence the protective service department had answered 537 out of 646 requests for special credit information. This service is free to members, as is also the service of the arbitration department, which has received 68 complaints of design copying and patent infringement, settled 48 without publicity, 13 having been withdrawn and seven being in process of settlement.

These services, together with the publicity, material exchange, sales promotional and other departments, are being emphasized in the association's drive to increase its 212 membership to 775 by Jan. 1, so that the annual budget of $54,000 may be met without a deficit.

The next national lighting equipment exhibition sponsored by the A. L. E. A. will be held the latter part of next January at a place yet to be chosen.

Although the exhibition in Chicago last June set a pace for lighting equipment manufacturers by proving that the day of the cheap fixture is past, results indicated that the summer months are not as favorable to exhibition purposes as January.

Seek to Eliminate Waste

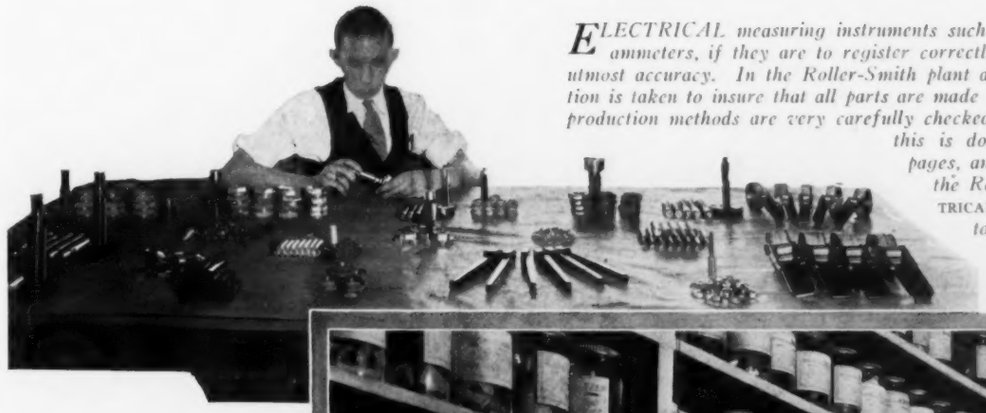
AN association committee is preparing standard specifications for the use of architects in connection with lighting equipment. The objective is to eliminate the waste and impractical requirements that are now prevalent because of the lack of knowledge of proper standards of practice.

Three representatives of the A. L. E. A. are working with a committee appointed by the Lamp Receptacle and Socket Section of the National Electric Manufacturers Association to draw up standard specifications and standards of practice in connection with wiring devices as now utilized by lighting equipment manufacturers. The objective of this activity is to bring about economies for fixture and wiring device manufacturers.

The group of lighting equipment manufacturers selling through wholesalers, organized some time ago, selected as chairman Leroy L. Reading, sales manager, electrical de-

(*Continued on page 72*)

Accuracy is *Required* in Measuring Instruments

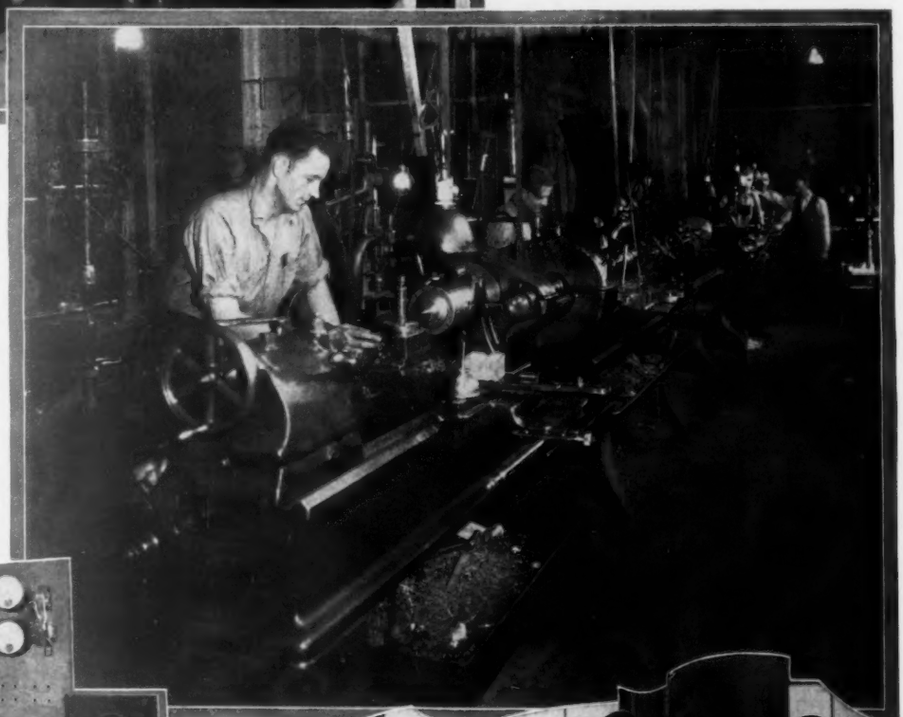


ELECTRICAL measuring instruments such as wattmeters, voltmeters, and ammeters, if they are to register correctly, must be constructed with the utmost accuracy. In the Roller-Smith plant at Bethlehem, Pa., every precaution is taken to insure that all parts are made exactly right, and these accurate production methods are very carefully checked by the most rigid tests. How this is done is shown on the following pages, and it is through the courtesy of the Roller-Smith Company that ELECTRICAL MANUFACTURING *is permitted to publish these views and descriptions of its manufacturing and inspection methods*

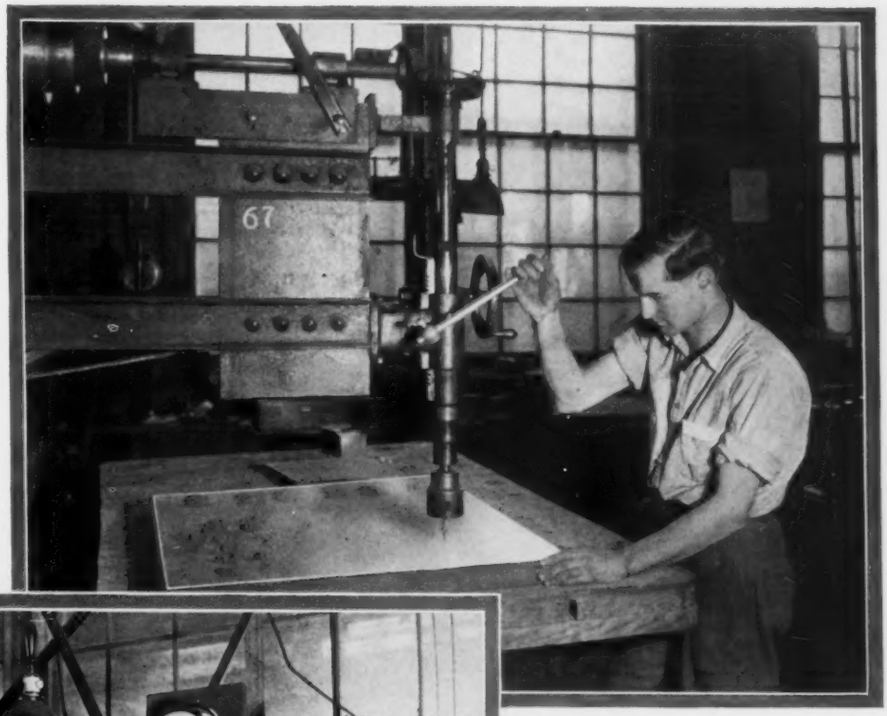
THE inspector above is gaging circuit breaker parts. Hundreds of gages are used in making circuit breakers and instruments. At the right is a section of the instrument stockroom, in which over 10,000 *different kinds of parts are stored, the smaller being kept in tightly sealed glass jars to insure cleanliness. The operator below is gaging pole pieces for small D'Arsonval type instruments, while the man at the lower right is inspecting alternating current portable voltmeters*

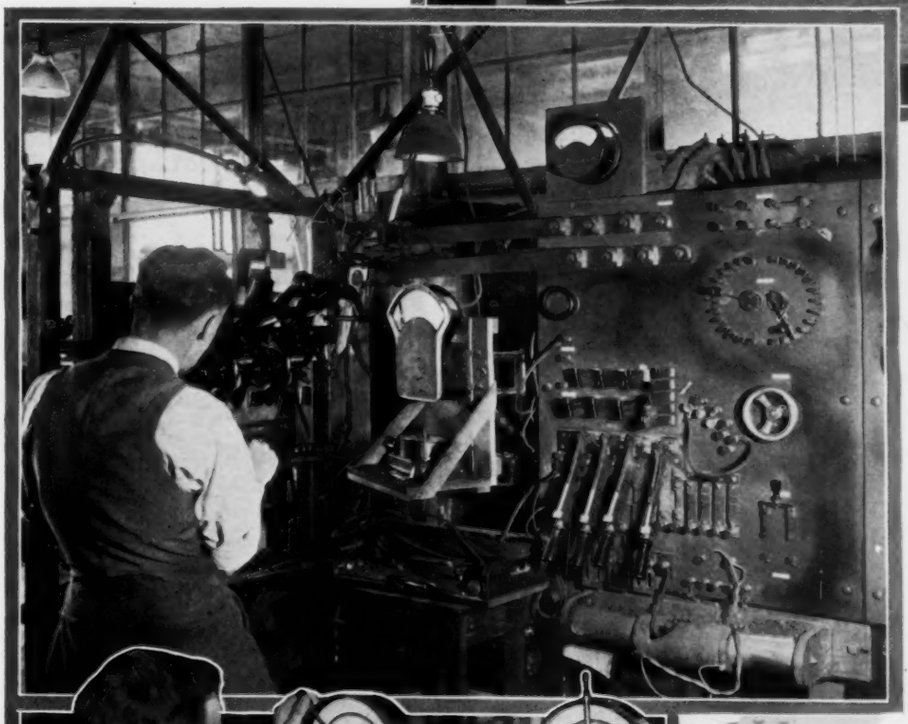
THE production of electrical measuring instruments and circuit breakers require the use of hundreds of different kinds of tools, dies, and gages, many of which are extremely complicated. These are all manufactured in the department shown in the view below. This, however, shows but a very small part of the extensive machine tool equipment required for this work, and, in addition, there is a large tool store room. The operators shown in the view at the lower right are assembling some of the moving units of direct current measuring instruments. Such operations are extremely exacting, to insure proper functioning of the unit, to the end that the instrument will register correctly in service. Practically all assembly operations in the Roller-Smith plant are performed in this manner

IN addition to measuring instruments and the larger types of circuit breakers, the Roller-Smith Company also makes a small circuit breaker, which the workman above is assembling. These smaller devices are mounted on racks during the assembly operation to expedite production. The man in the view below is checking the performance of direct current portable instruments, of which this company makes many different types. All necessary power circuits and controls are provided at the test stations

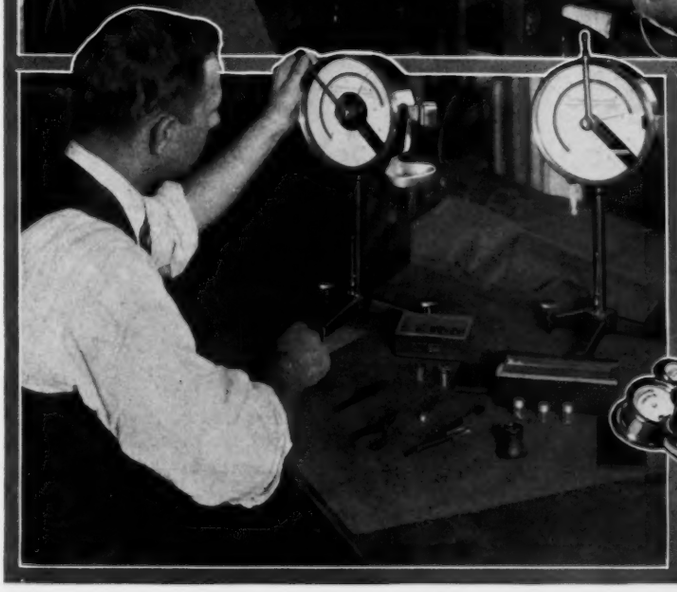


IT is the practice to mount circuit breakers on slate panels, and the operator at the right is shown drilling a panel of Pennsylvania clear black electrical slate obtained from quarries located near the Roller-Smith plant at Bethlehem. In addition to electrical measuring instruments, the Roller-Smith Company is a large producer of circuit breakers, and the "coil-in-arm" type that was invented in 1905 is still manufactured by this company. Below is shown one of the racks on which the finished circuit breakers are tested. In this case the operator is calibrating one of the devices. Since this operation is as exacting in its requirements as many of those performed in the production of electrical measuring instruments, considerable equipment is required, such as that on the panel

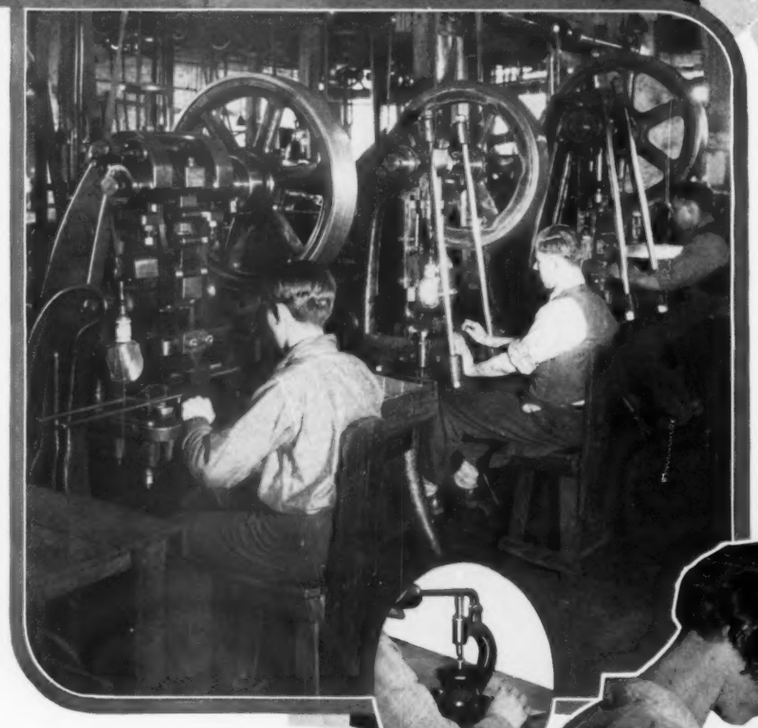




ONE of the most delicate and accurate instruments manufactured by the Roller-Smith Company is a torsion balance. It is very largely used by lamp manufacturers for weighing the deposit placed on electric lamp filaments. These devices are so highly sensitive that the smaller types will readily register the weight of a lead pencil mark on a piece of paper attached to the weighing arm. In spite of the great sensitivity embodied in these instruments, they are designed for rapid production methods, and consequently combine ruggedness with ease of operation. The operator at the lower left is shown testing one of these instruments, while the other operator, at the lower right, is performing one of the final inspection operations on a group of small D'Arsonval switchboard type instruments



ANOTHER product of the Roller-Smith Company is an instrument for testing bonds on electric railway tracks. The man above is shown testing one of the contact bars which is applied to the rail during the operation of testing the bond. Every contact bar is actually tested on a standard T rail before the device is shipped. Punch presses play an important part in the production of electrical measuring instruments and circuit breakers, and the view at the right shows a small section of the punch press department. All the punches and dies used in this section are made in the Roller-Smith tool room



THE operator above is performing one of the sub-assembly operations on direct-reading ohmmeters, while the operator below is examining instrument staffs under a high-power binocular microscope. This same method is employed for inspecting the sapphire jewels used as bearings in the instruments, as the bearings and the ends of the shafts that rotate in them must be very accurate with respect to size and contour

THE history of the Roller-Smith Company dates back some thirty-eight years, when the Whitney Electric Instrument Company was formed in Boston. The present Roller-Smith Company was formed in 1908, when F. W. Roller acquired control of the Whitney Company and D. R. Smith entered the consolidation, bringing with him the circuit-breaker business of the Switchboard Equipment Company, of Bethlehem, Pa. Subsequently the watt-hour meter business of the Columbia Meter Company of Indianapolis and the instrument business of the Wagner Electric Manufacturing Company of St. Louis were acquired

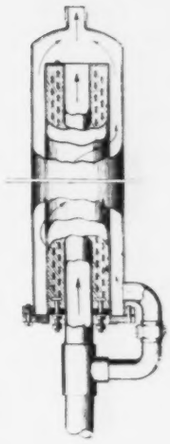
HANDY & HARMAN
FOUNDED 1867
QUALITY SERVICE

A Vital Problem Solved with

Handy Silver Solder

WE illustrate a new electric household water heater, now being successfully produced and marketed by a Milwaukee concern.

"Handy" Silver Solder came to the rescue after this company had spent much time and money trying to overcome leaky joints caused by sudden and unequal expansion due to the rapid heating from the electric unit inside the housing.



One welding company after another to whom the problem was submitted had to acknowledge defeat, whether using various formulas of hard solders or autogenous welding. Threading was also tried, unsatisfactorily.

Now that "Handy" Silver Solder is used there are no more leaks or failures. And they are now working with a *known* and constant resistance-value at the binding posts.

"Handy" Silver Solder combines strength with malleability to such a marked degree that it meets perfectly the difficult thermostatic and electrical conditions presented by this heater.

HANDY & HARMAN

General Offices—57 William St., New York, N. Y.

Plants

Bridgeton, Conn.; Providence, R. I.; Fulton and Gold Sts., New York, N. Y.

Handy Solders

are supplied in sheets, strips, wire and filings.

Our "Handy Book of Silver Solder" will interest you. Send for your copy.

RIBOHM

Bar-Type Ribohm is the trade name of a patented resistive element made only by Ward Leonard Electric Co. It is a special alloy metal, formed into a "U" shape for structural strength.

The resistive element has a practically zero temperature coefficient of resistivity, does not suffer from "fatigue" under vibration, and has a uniform cross section with resultant uniform temperature rise over the entire resistive element. Bar-Type Ribohm is continuous from terminal to terminal. Contact resistance is eliminated. Where bends occur, a special cross section prevents stresses in both the resistor and supports.

Weight for weight, Bar-Type Ribohm dissipates more energy than any other resistor. It is light, rigid, strong, and simple in construction and in use.

RIBOHM-A Heavy Duty Resistor

CONSIDER the economies of Ribohm used in place of weighty or bulky or fragile resistors which are still sometimes specified for heavy duty work.

Where Ribohm Resistors are used, the saving in cost of handling, shipping, and installing is great.

The least possible weight is used.

The bulk of the entire assembly is reduced. Ribohm is the lightest of all resistive elements and it dissipates more energy continuously than any other resistor of equivalent weight.

Ribohm is strong structurally. Ward Leonard recommends it for use in installations where there is the possibility of mechanical shock and excessive vibration.

Ribohm Resistors can be used economically wherever heavy currents are controlled by resistance. During the past seven years, Ribohm has been tested by actual service in all major fields of heavy duty resistor application.

The results of these tests, and their interpretation as applied to specific control problems, are available without obligation.

Your engineering department will find ours ready to give the fullest cooperation to determine the best application of Ribohm to your heavy duty resistor.

Bar-Type Ribohm Resistors may be mounted in groups containing any number of units. The illustration shows four Resistors, each mounted in a skeleton frame. Extra terminals are provided on each turn for taps.

WARD LEONARD ELECTRIC CO.
MOUNT VERNON, N.Y.

Before Entering the Export Business

Study Foreign Markets

For the electrical manufacturer who proposes to enter the export business there are many important factors that must be very carefully considered

LUCY A. GOLDSMITH

Miss Goldsmith is a foreign trade consultant and export trade analyst of the Goldsmith-Shore Company of New York, and was formerly export manager of the Aeolian Company of New York. She established the Goldsmith-Shore Company as foreign trade consultants in 1924 and is a contributor to trade and technical journals on foreign markets. Miss Goldsmith is one of the advisers of the National Foreign Trade Council and a member of the Export Managers' Club of New York and the League of Advertising Women of New York.

THAT this is an electrical age in the United States we all know, but how many of us realize the tremendous electrical development that has taken place all over the world?

It will, perhaps, be of interest to learn that there are at least thirty million homes electrically equipped outside of the United States; and, as is well known, this is practically double the number in this country. Furthermore, this estimated number of thirty million is probably conservative as it does not include estimates from various foreign countries which cannot be accurately obtained.

Many persons do not realize that this country is not the largest per capita consumer of electric current in the world but ranks fourth. Norway heads the list, followed by Canada, then Switzerland, and after that the United States, having only a little more than half the consumption of kilowatt hours per capita of Switzerland.

So, before attempting to analyze the export market it is well to look over a map carefully and plan our "selling trip" around the world economically and effectively.

Are we getting our proportionate share of these world markets for electrical equipment devices, and if not, what factors must be considered before we can bring about this desired result?

This country is protected by tariff and for many electrical products foreign competition in this market is barred. However, as soon as we leave these shores this is not the case. We then have to join in the rough-and-tumble, give-and-take of the best man wins in relation to world competition.

"THE first thing a manufacturer of electrical household equipment should think about when he starts an export sales campaign is, 'Where are my markets?' 'What is my competition?' 'Is my product salable in those markets and where can I find them?'"

The first thing a manufacturer of electrical household equipment should think about when he starts out on an export sales campaign is, "Where are my markets?" "What is my competition?" "Is my product salable in those markets and where can I find them?"

Markets vary for different products, goes without saying. For any product, however, it is of the utmost importance in starting an export business to lay out in advance a balancing of markets. By this I mean that even from the very beginning balanced selling areas should be laid out. In this way it is possible to enter every country as a logical development from the previous one, making each one an important wedge in the foundation for future world's sales distribution.

To my mind there are three ways of balancing markets. They are: seasonal balancing of sales; balancing of credit risks, and balancing of markets in relation to commodities.

Seasonal balancing of sales is really so obvious that it is hardly necessary to comment upon it at length. Most people will agree that it certainly should be extremely advantageous for products such as electrical fans to have an export business. They reach their high sales mark in the summer months and through the development of export business they can have an all-year-round season. When it is summer here it is winter in Australia and the Argentine and vice versa, and your factory could be kept busy during the slack season.

Another phase of export balancing of markets is in credits. Credit terms vary in different parts of the world. If one has a diversified sales distribution in various countries his credit terms differ in accordance with the customs of the country or the trade. This means that some pay cash against documents upon receipt of the goods, others 60, 90 or 120 days against documents, while still others (very rarely today) may open letters of credit in New York.

Latin America differs from the Far East in her system of credits and payments, and almost every European country has its own special terms for various trades. Further, if you are selling at 60 days sight against documents in Cuba this draft will fall due for payment in New York very much sooner than the same 60 day sight going to Argentina or South Africa. Therefore, your export sales should be so planned that these differing credit conditions are taken into account and the business spread over a greater number of countries, so arranged geographically that your money reaches you at well spaced intervals. In this manner your capital investment for export sales can be held down and regulated. Export credits can, of course, be insured against loss if so desired.

Balancing export markets in relation to commodities is to my mind one of the most important phases of planning export sales distribution. It is only possible to develop export sales channels in this manner if you are able to do so from the beginning. Otherwise you may just happen to go into various countries for some reason or other and find yourself selling into just those territories which are dependent upon the same basic commodity for their purchasing power. As an example, let us take Brazil and Colombia. In both countries their prosperity or purchasing power is practically dependent on coffee and its prices in world markets. If coffee goes down in value the purchasing power of Brazil and Colombia are so much decreased that if they do not curtail their own importations, manufacturers selling to them must, of necessity, do so by watching their credits very closely and do not urge their Brazilian and Colombian customers to buy at such a moment. Otherwise they will find themselves with continual renewal of drafts on their hands and collections difficult. If factors such as these are carefully watched in export trade we would hear very few howls of distress because of overdue collections and the troubles and worries of doing business in foreign countries.

¶ Commodity movements must be carefully watched in relation to export sales, for foreign countries have their fundamental purchasing power based upon sectional commodities and draft renewals will continue

Commodity movements must therefore be carefully watched in relation to export sales, whether it is sugar in Cuba, or wool and wheat in Australia and Argentina. As the two latter countries both have their fundamental purchasing power based on wool and wheat, I do not advocate going into these two markets simultaneously. If you start with Australia and develop a few other countries and then go into the Argentine or vice versa, it is, of course, perfectly all right.

That is why I suggest when beginning an export business that the countries should be carefully viewed, not only in relation to their own potential possibilities but also on the basis of how they fit in with your territorial distribution as it is being built up.

If you will compare what I have just said with regard to export sales and commodity movements with similar domestic situations you will realize that export business is really not different from domestic trade. If you are planning domestic sales possibilities in Kansas, California or Florida, it is certainly necessary to consider whether they have had good crops; no matter if these be wheat or citrus fruits. If you follow the trends of basic purchasing power in those sections you will know whether business is going to be good or poor there for you in the next six months. If there is a Mississippi flood you will know that the South is going to be affected immediately and if you are a wise business executive you make your plans accordingly. The same principle enters into the factors governing export sales.

From the foregoing you will have realized that in searching for additional markets by going into foreign countries, it is really not a hazardous undertaking if properly planned. It is merely a matter of ordinary business procedure and common sense. If your product is exportable there is no reason why you should not be getting your share of business to be obtained in foreign markets. The process is relatively very simple and if we know where these markets are, it is quite easy to go after them. Other people are doing so and getting their fair share of sales and profits.

Let us consider a specific product in a very brief fashion, such as vacuum cleaners. Obviously the countries which will yield the largest returns in the shortest time are those where labor is comparatively high. Conversely, if labor is very cheap the market will be limited. Climatic conditions also have to be taken into consideration, as for instance, vacuum cleaners will not be in great demand in tropical countries where tiled floors are the order of the day and rugs and draperies are conspicuous by their absence.

Australia is an excellent potential market for vacuum cleaners. Labor-saving devices are welcomed here as labor is high, and, miracle of miracles, there is no duty on vacuum cleaners in Australia. However, that does not say that the millennium has arrived. Other countries are on the job, too; our international competitors are not asleep. While American vacuum cleaners are popular in Australia, Sweden is a very strong competitor. In fact one vacuum cleaner of Swedish manufacture is the leader in some Australian sections. Their sales methods are as up-to-date and as modern as ours. A large amount of local advertising is being ably handled under the supervision of a direct factory representative, and the trade name of the cleaner is very well and favorably known to local householders. There are also several cheap German makes of vacuum cleaners on the market in Australia and these cost only about half the price of the American and Swedish makes. Therefore, considerable competition ensues. The instalment plan is in use and about 5 per cent of the purchase price is the customary down payment. American methods of merchandising are employed, such as house-to-house canvassers, and also direct mail methods. Efficient service departments are maintained and a financing plan is offered to customers.

"IN electrical household devices the crux of the whole matter lies in purchasing power, education and the directing of sales appeal to the local requirements. Social habits are important to study as well as manners and customs. Do not make the mistake of approaching the consumer with labor-saving arguments in a country where household servants are cheap and numerous. There is always a way to make an appeal on another basis. If you cannot reach them in one way it is generally possible to do so in another"

New Zealand is another market which is very favorable for vacuum cleaners and other types of household equipment. In the Argentine, vacuum cleaners are coming into use slowly. There is no reason why this market cannot be developed if gone after vigorously. Be prepared for strenuous competition, as the Argentine is always a hard market in which to make any initial headway. This is mainly due to the fact that manufacturers from every country send their best salesmen there, and the local merchants are extremely keen buyers, and not particularly favorable to American goods. At the present time especially, the Argentinians feel that this country is discriminating against them, due to our tariff restrictions on their refrigerated meat.

¶ Fundamentally our own sales methods may be adopted, provided there is no conflict with local mannerisms. Conflicting methods can be altered slightly to coincide with customs and conditions

Then various countries in Latin America point to an-

other field that should be looked to as growing and future markets. The sales methods employed will be different from those in England and Australia but fundamentally our own sales methods can be adapted, provided we do not run counter to any local conditions and customs, and these must be studied before you go into the market. I would venture into nearby Latin American markets such as Cuba and Mexico even though they may not be the biggest field for future expansion. It gives you an opportunity, however, to try out your products and sales procedure in a Spanish-speaking country. If you require catalogs or leaflets, or advertising, it will be a testing ground to show you how to develop your sales appeal for the Latin temperament and in the Spanish language.

Electric fans are naturally popular in warm countries; India being a very good market, although at the present time the United States has not as great a foothold as she should have. Price is a governing factor. American firms which have direct representations are able to secure a good quantity of the business. In other words, the demand is there and it needs to be gone after. The best way to handle this market unless you have a very well established export department, might be to give your representation to some manufacturers' representatives specializing in India and the Far East. There are some excellent houses here in New York having their own branches in Bombay and Calcutta and traveling representatives throughout India who should be able to give a manufacturer excellent sales representation in India.

The Philippines are also an excellent market for electric fans and one which should offer little difficulty to the American manufacturer, for as an American possession there are no duties and he has the jump on his European competitors.

Flashlights, of course, do not require the otherwise essential factor of electrical current and therefore can be sold in practically every country in the world. An average yearly export business in this product is shipped from the United States amounting to approximately two and one-half million dollars. Flashlight batteries are shipped to the value of slightly under two and one-half millions. Other batteries of the storage and primary types are also big sellers in the export fields, amounting annually to another $6,000,000.

Radio and radio apparatus is too complete a subject in itself to be covered in a general article of this kind. Suffice it to say that the last figures show a total of over $9,000,000 in annual exports, with every prospect for increase along this line.

¶ The exporting manufacturer of electrical equipment should follow closely and work in constant cooperation with foreign power plants and central stations, particularly American-owned plants

In relation to adapting our domestic sales methods wherever possible, it might be in order at this time to say a word here regarding the absolute necessity of the exporting manufacturer of electrical equipment following closely and working in constant cooperation with the electric power plants and central stations in all parts of the world.

This is particularly essential where they have the advantage of securing the cooperation of American or partially American-owned power plants in foreign countries. It is interesting to note the development along the lines of American ownership of this class of public utility which has recently occurred within the last four or five years in the various countries of Latin America. And do not forget this, the increased sale of electrical appliances is also of just as much importance to the public utility companies. If they cannot help to educate the public to the use of more and more electrical devices in the home they cannot hope to increase their "load" sufficiently to make it profitable enough to reduce their rates in the endeavor to induce the consumer to use more electric current. So it goes in a circle: power plant, manufacturer, consumer, dealer.

Speaking of dealers, another point of extreme importance is to educate your dealers and distributors or direct factory representative as the case may be, to understand the necessity of close cooperation with the local electric light and power plant. I have heard of cases where the dealers and local distributors of an unprogressive type have actually tried to block the efforts of the power company in educating the public to use more electrical appliances.

Sales quotas depend on so many factors—it is usually quite impractical to generalize about them. I do most emphatically consider them of value as an aim to shoot at. I have always found it advantageous to use them. They should not be considered on the basis of hard and fast rules which must be maintained but rather a flexible guide which can be adjusted as unforseen conditions arise.

In electrical household devices the crux of the whole matter lies in purchasing power, education and directing your sales appeal to the local requirements, personal tastes, and traditions of the people. Social habits are important to study as well as the manners and customs. Do not make the mistake of advertising or approaching the consumer with a labor-saving argument in a country where household servants are cheap and numerous. There is always a way to make the appeal on another basis. All it requires is a little study, attention and investigation. Furthermore, human nature is more or less the same the world over. If you cannot reach them in one way it is generally possible to do so in another. But local traditions and habits must not be roughly trodden upon.

To determine any sales policy for export distribution it is necessary to evolve a regular formula. Before tackling any sales problem ask yourself the above questions.

An Outline of a Preliminary Analysis for Developing Export Trade

(1) Is the product exportable?
(2) What percentages of production will be available or desired for export sales?
(3) What advantages will accrue from export sales?
(4) How do price policy and costs compare with competitive products in world markets? That is, not only American products, but European or those of local manufacture in the countries to be sold.
(5) Select territories on which to concentrate at the beginning.
(6) Check up on methods of sales procedure in general use for export in the specific industry under analysis.
(7) Estimate sales quotas for introductory period.
(8) Estimate initial expenditure.
(9) Estimate and budget necessary capital investment or capital absorption.
(10) Decide whether it is more advantageous and economical to handle export sales direct through company's own organization, or to promote sales through other methods; such as:
- **(a) Combination export managers.**
- **(b) Webb-Pomerene organizations.**
- **(c) Manufacturers' agents.**
- **(d) Export commission houses.**

Factors Influencing

In the use of materials handling equipment there are many savings to be realized that cannot always be computed as having an actual monetary value

By C. B. Crockett
The Society for Electrical Development, Inc.

IT has long been recognized in scientific circles that accurate measurements, combined with a terminology which was invariable and always clearly understood, contributed largely to the success with which scientific data, secured under one set of conditions, may be applied to another radically different situation. Materials handling and the choice of materials handling equipment has not yet arrived at what might be called a truly scientific stage. A plant executive confronted with a problem in materials handling does not have available scientific records which would be comparable in his own situation. He has rather to depend upon his judgment and knowledge of those factors which are to influence the savings which he may effect through mechanical handling. The purpose of this article is therefore to acquaint an executive with those factors which have influence in the operating cost of electric industrial trucks and in the savings resulting from their use.

Investment in materials handling must yield an adequate return. At the same time, this return cannot always be measured accurately in dollars and cents, and the intangible benefits may or may not be of greater importance than the actual dollar saving effected by the elimination of hand movement. Net profits from the installation of handling equipment are, of course, the difference between the total saving realized and the cost of operation. We may, therefore, first examine the operating costs, both direct and indirect, of electric industrial trucks and then treat with the savings effected thereby.

The costs of operation naturally divide themselves into the fixed charges and the operating charges, the distinction being that the fixed charges are not proportional to the amount of use made of the equipment and continue whether the equipment is idle or in operation. The operating charges are, in general, proportional to the hours of use made of the equipment. Equipment of the nature of electric industrial trucks has comparatively high fixed charges, but long life and dependability result in a low operating cost per year. Records from several hundred plants show that the average depreciation of the truck amounts to about $300 yearly; depreciation of battery running less than $200 per year with a small charge of $15 per year depreciation on charging equipment. Other fixed charges in the form of interest, insurance and storage charges may be figured at a maximum of $235 per year. These figures apply to single truck installations and are considerably decreased where a larger number of trucks are employed. We may conservatively say, therefore, that the fixed charges on equipment of this kind will amount, at a maximum, to approximately $750 yearly.

The operating costs fall under two main headings—the cost of power to charge the battery and the expense incurred in material and labor for maintenance and repairs. The power consumption of the average truck is less than 7500 kw-h. per year, and although many plants with wholesale power rates pay less than 1½c. per kw-h., we may take a rate of 3c. as being a conservative estimate, the power cost being approximately $225. Maintenance and repairs amount to very little for the first three or four years

In many manufacturing plants storage capacity is frequently overtaxed to meet ever-increasing production demands. Such was the case in the plant shown above, yet by the use of lift trucks and platform skids ample storage space was provided for the product

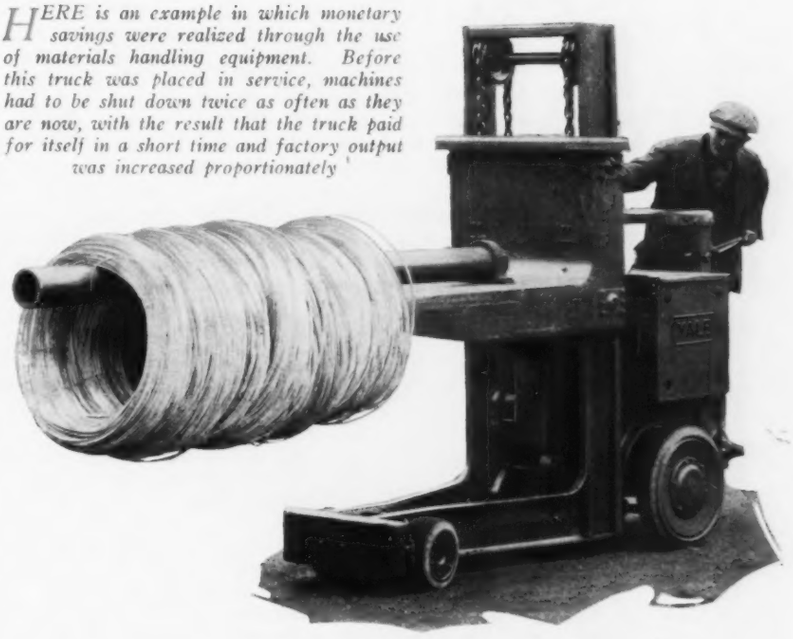
the Operating Costs of Industrial Trucks

of the life of the truck. If, however, we consider these expenses as an average for nine or ten years of life, we find that $275 per year will adequately provide for the maintenance necessary to keep the truck in excellent operating condition. Our operating charges, therefore, amount to approximately $300 per year, which, when added to $750 fixed charges, provide a total cost of $1,050 yearly, or something about 45c. an hour.

As 45c. an hour is the approximate wage for a laborer, we can draw the general conclusion that, as an operator's wage is 50c. per hour and the cost of a truck is a little less, it is an economical investment to supply a truck to perform a handling operation for which three men are at present employed. If these three men are replaced by an industrial truck with one operator, the saving in direct handling costs will amount to 33⅓ per cent.

The following specific examples of operating costs are given to show the variations which occur in actual operation. These figures were provided from the operating data of the several plants and, of course, may have been kept by different methods and the work performed by the truck will vary in each instance.

HERE is an example in which monetary savings were realized through the use of materials handling equipment. Before this truck was placed in service, machines had to be shut down twice as often as they are now, with the result that the truck paid for itself in a short time and factory output was increased proportionately



A foundry, operating 24 electric trucks, found the average yearly cost per truck to be as follows:

Truck depreciation	$135.00
Battery depreciation	97.00
Charging equipment depreciation	15.00
Interest on investment	119.00
Power at 1c. per kw-h	50.00
Repair and maintenance—labor	81.00
Repair and maintenance—material	138.00
Oil and grease	6.00
Annual equipment cost	$641.00

Another example is that of a truck operating in a steel plant where the operating conditions were very severe, resulting in high charges for labor and repairs. These, however, were offset by the fact that power was provided as a by-product of the main operation and was therefore very inexpensive for truck operation.

Power	$ 36.00
Labor and repairs	300.00
Truck depreciation	180.00
Battery and charging equipment depreciation	192.00
Annual equipment cost	$708.00

Total costs for truck operation will be influenced by the conditions under which the truck is operating, and the following factors are suggested as a guide to the executive who is considering the possible performance of mobile equipment.

Factors Influencing Operating Costs:

1. Length of haul
2. Amount of material to be handled
3. Condition of floors and runways
4. Number and severity of ramps
5. Continuity of the handling operation
6. Breakability of goods handled
7. Labor conditions in the territory
8. Range of use for which the equipment may be employed

George F. Swain, past-president of the American Society of Civil Engineers, has often been quoted as saying that a most common fault of the engineer is the carrying out of computations to a greater degree of accuracy than was warranted by the data from which these computations were made. Nowhere is this statement more applicable than in the field of materials handling, as the deciding factors in the purchase of such equipment are often those impossible to estimate in dollars and cents.

Conditions may exist within the plant which determine the choice of the equipment regardless of the direct labor savings. An example of this is found in the use of an industrial truck to handle bundles of wire in a nail mill. Prior to the installation of the truck the men tending the machine fed 150-lb. bundles to the machine as required. After the installation of the truck they could not eliminate

any of these men but it was possible to increase the size of the bundle to over 300 lb., which cut the number of times it was necessary to charge the machine by one-half and the increased production possible each day paid for the truck in less than a year.

At an electrical manufacturing plant the management was faced with the problem of increasing their storage capacity, but by the purchase of a high lift tiering truck which utilized space previously wasted they were able to avoid an investment of $25,000 in an additional warehouse.

A truck used in handling cotton bales was also employed to ram these bales firmly into place, and it was found that the same floor space could accommodate one-third more cotton due to this method.

Another plant handling copper billets found that a truck could perform the operation but without any saving in direct labor costs. The task, however, had been so strenuous that it was impossible to keep men employed on the work and the labor turn-over had been excessively high. In fact, they had found that men would not stay on the work more than one month, and if we estimate the cost of employing and discharging a man at approximately $25 we have a net savings of about $900 per year, as three men had been used in this operation.

The following possibilities for indirect savings should be considered as far as possible in figuring the net return secured through the use of electric industrial trucks. These are divided into fixed and operating costs for the plant.

Indirect Fixed Charges Affected by Use of Trucks:

1. Decrease in interest charges on manufacturing and storage facilities
2. Decrease in interest charges on inventories
3. Decrease in insurance charges on the two items above
4. Adaptability of the system to growth and to changes which may be effected in the operating method of the plant

Indirect Operating Charges Affected by Use of Trucks:

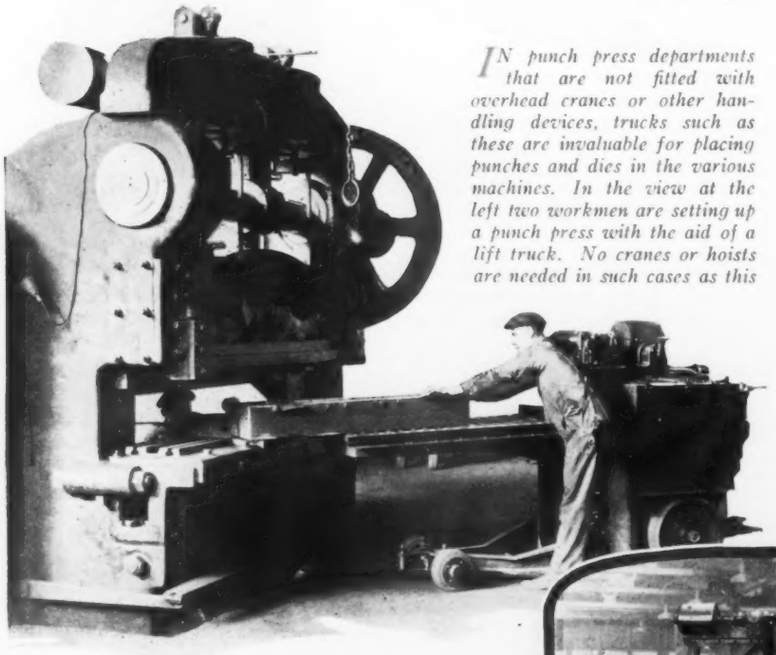
1. Decrease in labor burden and managerial overhead
2. Decrease in idle hours of production equipment and workers
3. Decrease in charges for goods broken in process
4. Decrease in hazards to workmen
5. Decrease in expenditures due to labor turn-over
6. Increase in general morale
7. Use of handling equipment as a pace setter

Offsetting these indirect savings we have the following indirect costs:

1. Interest on investment in any necessary changes in the plant
2. Value of lost production during these changes

Industrial electric trucks are now built in capacities from ½ to 15 tons. The theoretical savings which such equipment can effect is approximately the wages of 20 men, as the equipment can carry from 8 to 10 times the weight possible for a man to handle and at approximately 3 times the speed. One of the officials of the Westinghouse company hazarded an estimate that their fleet of approximately 80 trucks handled an amount of material which would require a force of 1000 men if these operations were performed manually. We have seen, however, that the direct labor saving is not always the governing feature, but due to the ease with which the savings from this source can be evaluated, it is in the majority of cases the basis for the decision to purchase equipment of this kind. It is hoped, however, that some of the factors mentioned in this article will be considered by those executives who are anxious to derive the maximum return possible from the use of electric industrial trucks.

Industrial trucks can be adapted to permit of their transporting almost any kind of material or product and they can be operated any place where there are suitable floors or roadways; to the end that these trucks, of one type or another, can be used in practically every industry.



IN punch press departments that are not fitted with overhead cranes or other handling devices, trucks such as these are invaluable for placing punches and dies in the various machines. In the view at the left two workmen are setting up a punch press with the aid of a lift truck. No cranes or hoists are needed in such cases as this

AT the right is an example of a case wherein it might be out of the question to estimate the savings realized from this method of storing materials. The stock parts are easily transported from the factory, stored and counted, for each skid load comprises an inventory unit. Also notice the inexpensive storage racks, and then at the same time take into consideration the valuable floor space that is being conserved when the skid loads are placed one on top of the other, as is done here

MEASURING *Instruments* and *METHODS*

No. 3 of a Series on Electrical Testing Instruments and Methods

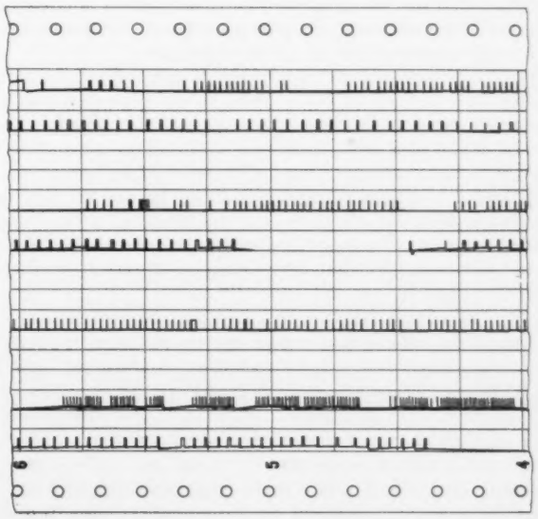
Graphic recording instruments of both the strip chart and the circular chart types are used extensively in industry for recording the performances of all kinds of mechanical equipment

By D. H. BRAYMER
Consulting Engineering Editor
ELECTRICAL MANUFACTURING

IN the first of this series of articles the necessity for the use of electrical testing and measuring instruments was outlined, with an explanation of their application and construction. The second article treated primarily with the use of graphic recording instruments and the discussion begun in this article is carried out in the following, which explains more in detail some of the applications of graphic recording instruments and the results that may be obtained from their use.

Service and Production Recorders.—These meters are used for recording machine operations, elapsed time, and for graphic counting. They have been used to secure information that would otherwise be difficult to obtain in the following tests.

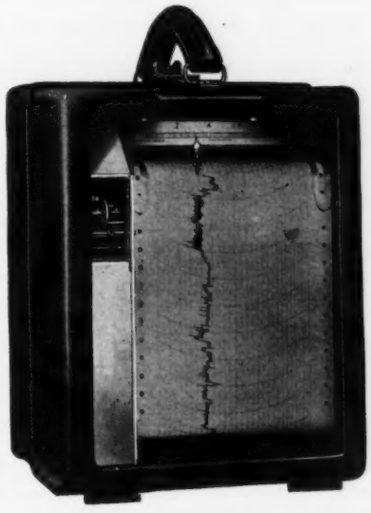
A large department store operating a fleet of delivery trucks makes a test on every driver making application for employment, in order to determine the quickness and accuracy of his actions and his ability to get through crowded traffic with minimum damage to his vehicle. A standard delivery truck is wired so that each operation the driver performs will close an electric circut through one of the pen elements of a fourteen-pen Esterline-Angus time recorder. Likewise a series of electric signals, placed on the wall in front of the driver, are wired so that when a signal is lighted a pen of the time recorder is moved. The applicant is seated at the wheel of the truck and told to obey,



This is a section of a record taken on seven hand screw machines. Each line on the chart indicates the completion of a finished part. From these the rate of production and the uniformity of the operation of each machine may be easily determined and corrections made when needed

as quickly as possible, the signals as they are flashed on. By this means a record is made on the chart of the exact time, in fractions of a second, of the time required by the operator from the flashing of the signal to the execution of the necessary operations to comply with it.

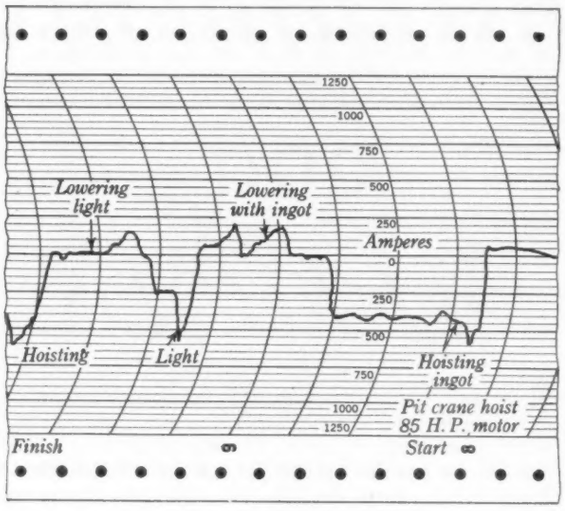
The speed and accuracy of the reactions of the human mind vary widely in different individuals and these tests show conclusively that previous to the installation of the testing equipment, many drivers were being employed whose



An Esterline-Angus graphic recording instrument of the portable type. Notice the compact construction, the clear view of the strip type chart and the fact that all connections can be easily made from the outside

reactions were so slow and so inaccurate as to make it almost certain that they would not make satisfactory drivers. Delivery trucks are too expensive to smash up in the process of determining the qualifications of the men who are to handle them. Similar test records for airplane pilots are also made by these instruments.

In hospitals these instruments have been installed so that, when a patient rings for a nurse or an attendant, the instrument records the time which elapses until the call is answered, which record is of vital interest to the department having supervision of these attendants.



The two charts on this page show how electrical men use graphic meters to aid them in locating and correcting trouble with equipment. The chart above, which is a center zero chart, so that values must be read from the center line, was taken while there was trouble with a hoist

These instruments are also used in conjunction with a weather vane having contacts wired to the instrument so as to record the direction of wind at any time during the day and night and for a continuous period of time. Telephone companies make use of this type of instrument on trunk line circuits to determine accurately the loading on these trunk lines at all hours of the day. They are also used for checking the length of conversation on party lines. Customer complaints are frequently eliminated by these records.

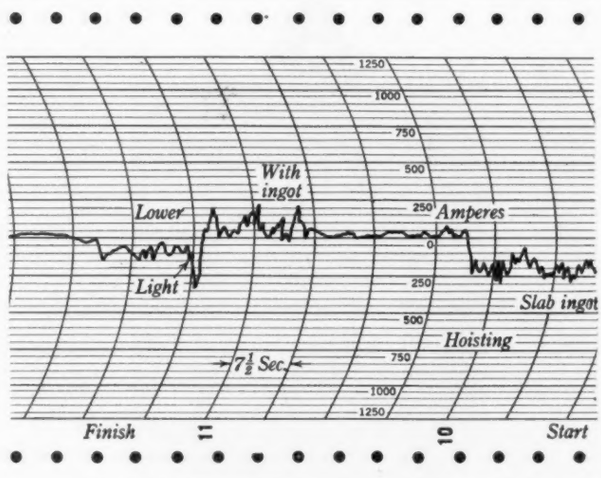
In the operation of elevators for passenger service in large buildings where these elevators must follow a closely regulated schedule, these time recorders provide not only a check on the operators but make it possible to revise schedules as conditions require. These time recorders can be wired so that they will indicate the number of stops up and down for each elevator and the duration of these stops. They will also show when each particular signal button is pressed and the length of time passengers wait before being picked up. In addition the meter can be so connected into the circuits to show which elevator answers a call on a certain floor and whether the first or any elevator passed by the signal. These records not only show the effectiveness of the schedule and the speed and accuracy of the operators in observing them but can also be made to show how control equipment for elevator operation operates such as the speed of closing of elevator contactors and the like.

In industrial work records of productive work from machines operating singly or in groups are vital elements to cost keeping records. These time recorders can be used for this purpose to indicate starting and stopping of machines and the length of time they are doing productive work. In this connection graphic wattmeters are also used in obtaining records of productive work, since these wattmeter records show in addition to the information furnished by time recorders the amount of power taken by a machine for a particular operation, and thus make possible the power cost record as an element of the total production cost in manufacturing operations.

The time recorder mechanism consists of a series of writing pens each operated by a small electro-magnet. When an electro-magnet is energized, it moves the pen which it operates so that it draws a short line on the chart. The instrument is operated by connecting it to a source of current through contacts which are opened and closed by the operations it is desired to record. Standard recording elements having five, ten or twenty pens can be placed in a single meter, so that a record of as many as twenty different operations can be made on one chart. Twin type cases will accommodate as many as forty pens. Owing to the tendency of alternating current magnets to vibrate, the pen tube is not fastened to the meter element. The tube is passed through a loop at the end of the driving element so that any vibration of the mechanism is not transmitted to the pen.

In the operation of condensers graphic recording charts are valuable to show the operation condition of the equipment at all times

INSTRUMENTS can be secured to operate on direct or alternating current, at voltages ranging from 6 volts to 750 volts. The operation of the pens is exceedingly rapid, each pen being capable of recording distinctly as many as five operations per second. The record charts used in these recorders as made by the Esterline-Angus Co. have rectangular coordinates which make the pen tubes all of the same length and places the pens in a straight line across the chart. Charts are 6 inches wide and 90 ft. long and can be furnished printed for chart speeds of either, 3/4, 1½, 3, 6 and 12 in. per hr. Three types of chart drives can be obtained, namely spring-wound, electrically operated and motor driven clocks, the spring-wound clocks being mostly used. An attachment is also available which provides the same chart speeds per minute as indicated above per hour. The electrically driven clocks are of the impulse type adapted for use on standard impulse time-keeping systems. Motor driven charts are used for especially high speed operations.



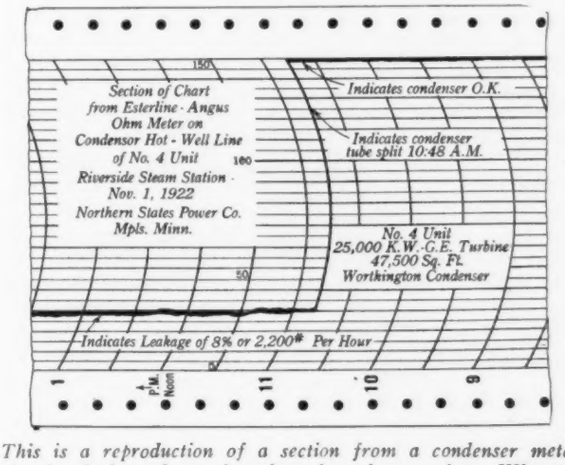
This chart and the one above are good examples of the practical use of graphic recording instruments in the maintenance and operation of hoists. In this case the chart above indicated trouble with the equipment, while this chart shows conditions after repairs had been made

Condenser Recorders.—This graphic meter is used to furnish a record of the contamination of the condensate from a surface condenser installed in a power station, due to either leakage of the cooling water or to priming of the boilers. If cooling water used with surface condensers is pure and soft, a considerable amount may be permitted to find its way into the condensate without doing serious damage, but there are a large number of plants using cooling water of such a nature that a very small percentage in the condensate becomes a serious matter and causes injury to engines and turbines.

With this meter a sturdy electrode is used which furnishes one resistance element of the meter. The meter itself is essentially an ohmmeter having a dynamometer element. It registers the resistance of a column of the condensate between the electrodes immersed in the liquid. The meter element has two pairs of stationary field coils and two moving coils which are mounted in planes at right angles on the staff, carried on jewel bearings. One of the moving coils is connected across the line through a fixed resistance and the other across the line at the resistance which is to be measured. When the resistance to be measured changes, the torque produced by the coil with which it is connected in series changes proportionally. Since the two moving coils are mounted on the same staff which carries the pen, the latter will take up a position where the torques produced by the reactions between currents in the moving coils and their respective magnetic fields are in balance. A transformer which is connected in the multiplier case of the instrument is interposed between the line and the meter so that a grounded connection to the electrode installed in the condenser will not cause a ground on the supply circuit.

Boiler concentration meters are manufactured in portable types to record the concentration of salt in boilers

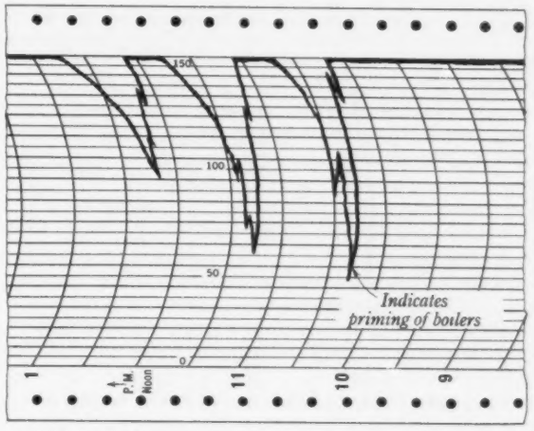
THESE condenser recorders are provided with a scale corresponding to 3000 ohms full value so that with the standard electrode furnished the reading will be full scale when the condensate is pure distilled water. For measuring resistances of liquids other than water, the electrode area is changed so that the meter can be used with the same scale calibration and same record charts. This type of meter is furnished in a single chart speed of 1½ in. per hr. which provides a continuous record for a period of about 30 days. They are furnished for operation on 110 volts and for the frequency for which the meter is calibrated. In operation when the meter is used with a condensate equal to pure distilled water, the pen records at full scale. When the resistance of the condensate is changed by the introduction of anything that will change the resistance, the pen will move away from the full scale value and indicate the time at which leakage occurs and the extent of the contamination of the water. Priming of boilers is indicated by sharp fluctuations of the pen movement extending over the period the priming takes place and indicating the frequency of this action, which makes it possible to locate the cause and apply the remedy.



This is a reproduction of a section from a condenser meter, showing leakage due to bursting of condenser tubes. When the condenser was in good condition the record was at the top of the chart, but when the leak started, it immediately dropped to near the bottom of the strip

The condenser recording element can be combined with a vacuum recording element in a twin case for switchboard mounting so that a very effective unit is possible giving full data on the performance of the surface condenser.

Boiler Concentration Meter.—This meter is designed in portable form and is used to measure the concentration of salts in boiler water in order to control the time and period for the blowing down of boilers. This is an indicating instrument and does not have a clock movement nor use a chart. The meter element is an ohmmeter of the induction type. Since the resistance of the water depends on the salts in solution, a measure of the resistance is an indication of the amount of chemical salts in the water. Two meter elements are used which tend to move a disc in opposite directions. A fixed resistance is contained in the case and connected in the circuit of one element. The resistance to be measured is connected in the circuit of the other element, this resistance being offered by a path through the solution to be measured. A measured quantity of this solution is placed in a cup section provided on the case of the instrument and provides the resistance to be measured. The instrument is calibrated so that the point of equilibrium, where the disc comes to rest, represents the resistance of the circuit through the liquid. This indication is shown by a pointer over a calibrated scale corresponding to the temperature of the solution measured. Scales are provided for different temperatures. This meter is calibrated from a sample of boiler water furnished by the user, this sample being furnished for the highest concentration it is desired to operate the boilers. The resistance range of the instrument and the scale provided is then furnished to suit the actual conditions of a particular boiler using the water of its particular location. This instrument is provided for operation on 110 volts, 60 cycles.



In this case priming is not steady and the record on the graphic chart shows the variation in the resistance of the condensate due to quantities of water being carried over. There are several causes of priming that can almost always be stopped if the operator knows when it occurs

The next section of this article will take up special indicating instruments used for special testing and for the securing of information to supplement the readings secured by standard indicating instruments.

Editorials

Dependable Repair Service Merits a Legitimate Profit

DEPENDABLE electrical repair service carries with it an expert knowledge of a wide range of electrical devices and usually years of experience. This is especially true in connection with motor rewinding, and by reason of this fact this kind of service merits a compensation that will include a margin of profit sufficient to make it possible to employ skilled workers and to provide the necessary apparatus to handle the varying nature of rewinding jobs that are encountered.

To present the average status of rewinding charges throughout the country, below which a well equipped shop should not be required to lower its standards of work in order to make a legitimate profit, ELECTRICAL MANUFACTURING has assisted in the presentation of the useful data that appear in an article elsewhere in this issue. Among other things, the compilation of average rewinding and repair charges plainly indicates too wide a spread in the return for the same class of work in various sections of the United States. It indicates also that if those who are able to get the top of the return are doing so because of high-grade work, then those who are getting less for the same job are either dipping deeply into profits or reducing the quality of the work done to make a low price for the work.

The average charge for the class of work discussed further discloses that the old rule of thumb method of estimating rewinding costs, namely, one-half the price of a new motor plus ten per cent is not a safe method to employ at the present time. In fact, when a complete burn-out of motor windings requires the complete replacement of the windings in a general purpose motor, and this rewinding job is done with such a knowledge of the cause of the burn-out as to provide the needed correction, if due to operating environment or service conditions, the repaired motor represents a new design and the delivery of a special purpose motor which measured in terms of service that it renders should equal in price to the customer that of a new motor. Between this price and the amount that competition may establish lies the average return for a high-grade job. It is then the work of good selling to bring this price as close as possible to its merited level. To this end a careful analysis of actual repair costs will go far when high grades of material and expert skill are employed in the rewinding operation. The data presented in the article referred to will not permit the blind application of it in all cases but it will aid in establishing the limit between profit and a loss on a high-grade rewinding job and indicate where more detailed cost data are essential to conduct a rewinding business on a basis satisfactory to the customer and fair to the owner of the shop who makes this service available to him.

Growing Competition for Chain Stores

ELECTRICAL manufacturers who have been asking themselves what part the chain stores will play in the future distribution of electrical products should find it helpful to read and study an article appearing in the Feb. 28, 1929, issue of *Printers' Ink*, entitled "How Far Can the Chain Store Go?," by William A. McGarry. After a careful investigation, Mr. McGarry has come to the conclusion that "the chains will get and hold the lion's share of certain standard products, but that before and after standardization the chains cannot compete with the independent merchant."

The comment of a manufacturer interviewed by Mr. McGarry provides food for reflection. The manufacturer said, in part:

"The average chain store cannot afford to permit a manager to remain in charge of one store who is competent enough to compete with an intelligent and marketwise independent merchant. If he has that ability he is worth more at headquarters, where it may be applied to the whole business. The chain store which fails to recognize this loses a good manager to another chain or accumulates a competitor across the street. Many successful independents could earn ten or twenty times as much money by selling their ability to a chain. But some men can not be hired, and this untrammelled group is resourceful, energetic, and daring. Its members can survive experiment that would ruin a chain system. The only way to eliminate the independent is to eliminate that type of man."

New Kind of Plug Cap Needed

REPEATEDLY one hears it said that the cord is the weakest part of an electric appliance. No doubt this is true when sub-standard cord is used in connection with an approved appliance. But it is not necessarily true when standard cord is used with an approved appliance. Observation has about convinced the editor that cords are not so much to blame for the frequent short circuits in the use of appliances as the design of attachment plugs, especially the plug cap. A well-made plug cap, especially one with the standard parallel blades, usually fits snugly into a convenience outlet, and frequently it fits tightly. In disconnecting a plug cap from an outlet the average woman's fingers slip off of the rounded surface of the cap. It is small wonder therefore that frequent use of an appliance develops the habit of jerking out the plug cap by pulling on the cord, breaking it down of course more rapidly than the cap itself. If the manufacturers of appliance cord could persuade the manufacturers of attachment plugs to design a plug cap that could be gripped easily by the fingers, the cord manufacturers would escape a lot of trouble and the appliance user would find it easier to remove caps from outlets without damaging the cord.

Materials Handling Equipment

CONFRONTED as he is with the problems of competition, distribution, marketing, high labor costs, and the ever-increasing prices of materials, it would appear that the electrical manufacturer has enough to worry about without considering other matters. There is another problem, however, and one that in this day of mass production may spell the difference between profit and loss.

It is that of deciding how materials, now required in such vast quantities, are to be handled through the various production operations. Just as machines are replacing the skilled workman so must materials handling

equipment, in one form or another, replace manual labor, in so far as the latter relates to the transportation of materials in industrial plants.

No manufacturer can hope to achieve success or meet present-day active competition unless, in some measure, he adopts the means or methods of others who are successful. And, being successful today requires the fullest utilization of the best obtainable in workmen, plant, equipment, methods and materials.

Of course, materials handling equipment requires an investment, and, like other invested capital, that invested in materials handling equipment must yield a fair and adequate return. At the same time, this return cannot always be measured accurately in dollars and cents, and some of the intangible benefits may or may not be of greater importance than the actual dollar saving effected through the elimination of manual labor and other antiquated methods.

Net profits from the installation of handling equipment are, of course, the difference between the total saving realized and the cost of operation. All of this is more fully explained in an article beginning on page 48, which has to do with the factors influencing the operating costs of electrical industrial trucks in manufacturing plants.

The Large Potential Spanish Market

THE Spanish market for American electrical equipment and appliances is one of the best in the world, when it is considered both with respect to the value of goods taken each year and the constancy of the quantities required. According to the United States Department of Commerce, Spain consumes no small part of the total annual exports of this country, as may be seen from the fact that during the years 1923 to 1927 exports from this country to Spain totaled, respectively, $2,052,-124, $1,728,691, $2,416,760, $1,710,989, and $1,809,949. Among the items included in these various amounts were electrical goods of almost every kind and class.

American products are regarded with high repute in Spain and, despite a well-organized Spanish manufacturing industry and considerable active competition from other European manufacturers, American electrical goods are generally recognized as standard. Extensive investments of American capital in Spanish factories and industrial enterprises, as well as utilities, are partly responsible for this situation.

Spain has a very extensive program of water power development, which has already been started and which will add several hundred thousand horsepower to the present facilities. Primarily, this program includes four hydro-electric developments, electrification of all steam railroads, and the construction of a national power line that is to interconnect the old and the new hydro-electric developments with steam plants in the coal mine centers, to form a super-power transmission line all around Spain.

Such developments as these, several of which are well under way, with others in the formative state, are bound to increase the demands for electrical products. Then, inasmuch as 75 per cent of the homes are electrified, there should be an increased demand for appliances and other devices. But, according to an article appearing elsewhere in this issue of Electrical Manufacturing on the possibilities of the Spanish market, there appears to be no serious effort on the part of utilities and dealers to promote the sale of appliances. Hence, it would seem that extensive sales can be developed in Spain for all manner of electrical equipment and appliances, if American manufacturers will exert more effort to promote their products in this rich and rapidly expanding country.

Guesses at Causes of Trouble Often Lead to Expensive Cures

LESS expert knowledge of conditions is required in obtaining test data with instruments than in the interpretation of the readings obtained. When the compilation of the test data and the interpretation of the results must be done by others than those using the instruments, it is essential that the data supplied shall be as complete as possible so as to eliminate guesswork and too liberal drawing on accumulated experience.

To indicate ways of securing test data that will supplement readings of indicating and graphic instruments, there are presented on pages 51-53 in this issue of Electrical Manufacturing some suggestions worthy of consideration concerning the use of special testing equipment. These suggestions should be of particular interest to those members of a manufacturing organization whose job it is to answer service complaints of customers located at distant points. Such complaints seldom give a true picture of the conditions because they usually convey impressions or guesses at the real causes of the difficulty without complete and detailed information with supporting data. To guess therefore at the answer to such a complaint may create a costly situation for all concerned.

The use of the suggestions referred to, covering the application of special testing instruments and the results that can be secured, will aid in a quicker remedy of the trouble and at a lower cost than possible by cut and try methods based on what may or may not be wrong. Besides, by referring the customer to the use of these instruments with which he may not be entirely familiar, an effective means may be suggested that will enable him to check into future troubles and correct them without the delay and the unsatisfactory results that sometimes come from long drawn out correspondence.

Motor Repair Costs

THE number of electric motor repair shops in this country today is legion, yet they continue to spring into existence by leaps and bounds. True, more motors are in use today than ever before, but is their number increasing at such a rapid rate as to supply sufficient business for this ever-growing number of motor repair shops?

Decidedly, it is not. It is not surprising, therefore, that many of these smaller shops, as well as some of the larger ones, are fighting to keep alive. Not only that, but those that are merely existing are cutting seriously into the business of the older, and more firmly established organizations. So much so, that the price battle which is waging, will, if continued, inevitably hurt some of these shops.

This fight has resolved itself into the old familiar practice of price cutting and it will be won by those best fitted to carry it on the longest. Many of these small shops, as well as the fly-by-night repair men, do not know what constitutes a fair price for motor repair work. Some of them have very little overhead, which permits of their taking in work at almost ruinous prices. by doing this they may be helping themselves, for a time, but in the long run they are hurting themselves and the industry as a whole.

At any rate, in fairness to themselves and to their patrons, who will not deny it, every motor repair shop conducting a reputable and reliable business is entitled to reasonable prices for its work. For this reason, and in order that there may be some mutual understanding as to prevailing motor repair prices throughout the country, there will be found elsewhere in these pages an article that explains how to estimate motor rewinding costs.

Estimating SIZES of BLANKS for Drawn *Metal* Parts

No. 3 of a series on the design and manufacture of stampings

In designing and producing metal stampings and drawn parts there are certain definite rules to be followed to obtain the most satisfactory results

By J. K. OLSEN
Chief Draftsman, Stewart-Warner Speedometer Corp.

IN determining the size of blanks for drawn parts, the area of the metal necessary to form the part is the major consideration in most cases; the rule being, "Drawn part blanks are figured by area."

In theory the area of a blank does not change, regardless of the many different shapes the metal assumes when subjected to a drawing operation. In practice, however, there is generally a very slight difference in area between the blank and the finished part, due to the stretching of the metal. The design of the die determines this slight difference, therefore, it is not generally good practice to consider it as one of the factors used to determine the blank size.

The most accurate method for determining the correct blank size is, of course, by the "cut and try" method, or by checking the size of the blank by actual operation in the press. All die makers are familiar with this process. It is very unsatisfactory from a production standpoint as it is common practice for manufacturers to determine from the size and shape of the part to be drawn the approximate amount of material per blank in order to purchase raw material before the construction of the die is finished.

In the following paragraphs a description of this method is given, together with data and instructions for its use.

The most common of all drawn parts will be found to have a radial form in the bottom and corners, so this phase of the subject will be offered first.

In the accompanying table there is given a ratio for arcs, followed by a constant for each ratio.

The ratio must first be found by dividing the thickness of stock used by the inside radius of the part.

For example: Ratio = Thickness of stock × inside radius.

After this ratio has been computed the constant may be found for it in the table, the constant being given opposite the ratio.

When this constant is found, the length of the arc for 90 deg. is available by multiplying the inside radius of the

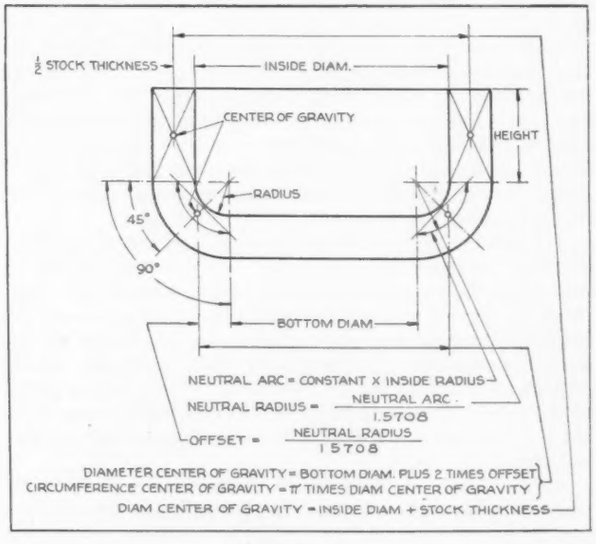

½ STOCK THICKNESS
INSIDE DIAM.
CENTER OF GRAVITY
HEIGHT
RADIUS
45°
90°
BOTTOM DIAM.
NEUTRAL ARC = CONSTANT X INSIDE RADIUS
NEUTRAL RADIUS = NEUTRAL ARC / 1.5708
OFFSET = NEUTRAL RADIUS / 1.5708
DIAMETER CENTER OF GRAVITY = BOTTOM DIAM. PLUS 2 TIMES OFFSET
CIRCUMFERENCE CENTER OF GRAVITY = π TIMES DIAM CENTER OF GRAVITY
DIAM CENTER OF GRAVITY = INSIDE DIAM + STOCK THICKNESS

Figure 1

This illustration shows the most common characteristics of the drawn shell problem. The center of gravity is located in two separate portions of the piece, thereby determining its area

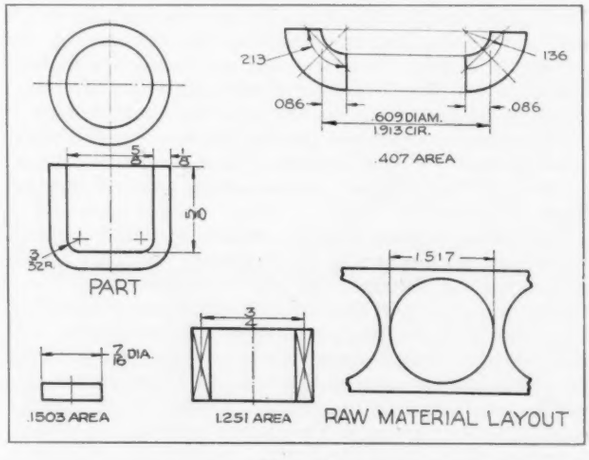


Figure 2

Here are shown all of the different steps in the development of a drawn metal part, in this case a plain cup. The various dimensions were obtained by the use of the formula explained herein

part by this constant. The length of this arc which we have just determined is called the neutral arc and is the determining factor for the area of material in the curved or radial corners in the part.

It should be carefully noted at this time that this procedure is correct for 90 deg. forms only.

Example of 90 Deg. Arc

The length of neutral arc for a 90 deg. form is found by a very simple calculation; for instance, if we have 1/16-in. for stock thickness and 5/64-in. for inside radius, the ratio will be the thickness of stock divided by the inside radius which gives us 1/16 ÷ 5/64 or .0625 ÷ .0781 = .800 ratio.

Looking in the table we find that opposite .800 are the figures 2.164, then .0781, or the inside radius, times 2.164, or the constant, will give the length of the required arc.

.0781 × 2.164 = .168 or length of arc.

As can readily be seen by looking through the table, no constants are given below .760 ratio, or above 8.090 ratio.

If the ratio is below the smallest in the table, one-half of the thickness of metal is added to the inside radius and if the ratio is above the largest one, one-third of the stock thickness is added to the inside radius for finding the neutral radius.

In figuring the length of neutral arc where stock thickness is used as a constant, it can be found by multiplying the radius of the neutral arc by .01745 times the angle.

Figure 1 shows the most common characteristics of the drawn shell problem. As may be readily seen, the center of gravity is located in two separate portions of the part, thus locating the areas which are used in figuring the blank.

The common terms, as given in the illustration to indicate the various parts are in general use in drawn shell problems.

(A) The circumference of the cylindrical part, as required for drawing purposes, is found by multiplying the diameter of the center of gravity by 3.1416. By multiplying this result by the height of the cylinder, the area of the cylindrical portion of the part is found.

(B) The area of the bottom portion is found by using the diameter inside of the two radii in the corners and calculated directly as the area of a circle, or 3.1416 r^2.

(C) The necessary stock for the radial corner in the bottom of the part is slightly more complicated to determine

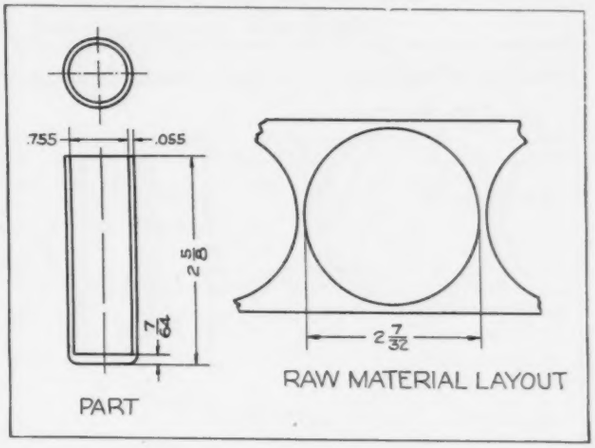


Figure 3

This illustration is an example of a problem in which there is a difference in the thicknesses of the bottom and sides of the piece. The solution requires a different formula than any of the other cases

Table of Ratios and Constants

Ratio	Constant	Ratio	Constant	Ratio	Constant	Ratio	Constant	Ratio	Constant	Ratio	Constant	Ratio	Constant	Ratio	Constant
Use ½ Thick		0.980	2.185	1.410	2.318	1.860	2.567	2.310	2.849	2.910	3.218	4.690	4.079	6.490	4.915
0.760	2.160	0.985	2.185	1.420	2.322	1.870	2.573	2.320	2.855	2.950	3.243	4.730	4.098	6.530	4.933
0.770	2.161	0.990	2.186	1.430	2.325	1.880	2.580	2.330	2.861	2.990	3.269	4.770	4.116	6.570	4.952
0.770	2.161	0.995	2.186	1.440	2.328	1.890	2.586	2.340	2.868	3.030	3.293	4.810	4.135	6.610	4.970
0.775	2.162	1.000	2.187	1.450	2.331	1.900	2.592	2.350	2.874	3.070	3.319	4.850	4.153	6.650	4.989
0.780	2.162	1.010	2.188	1.460	2.335	1.910	2.598	2.360	2.880	3.110	3.337	4.890	4.172	6.690	5.008
0.785	2.163	1.020	2.191	1.470	2.338	1.920	2.605	2.370	2.886	3.150	3.356	4.930	4.190	6.730	5.026
0.790	2.163	1.030	2.195	1.480	2.341	1.930	2.611	2.380	2.893	3.190	3.374	4.970	4.209	6.770	5.045
0.795	2.164	1.040	2.198	1.490	2.344	1.940	2.617	2.390	2.899	3.230	3.393	5.010	4.228	6.810	5.063
0.800	2.164	1.050	2.201	1.500	2.348	1.950	2.623	2.400	2.905	3.270	3.411	5.050	4.246	6.850	5.082
0.805	2.165	1.060	2.204	1.510	2.351	1.960	2.630	2.410	2.911	3.310	3.430	5.090	4.265	6.890	5.100
0.810	2.166	1.070	2.208	1.520	2.354	1.970	2.636	2.420	2.918	3.350	3.449	5.130	4.283	6.930	5.119
0.815	2.166	1.080	2.211	1.530	2.360	1.980	2.642	2.430	2.924	3.390	3.467	5.170	4.302	6.970	5.138
0.820	2.167	1.090	2.214	1.540	2.367	1.990	2.648	2.440	2.930	3.430	3.486	5.210	4.320	7.010	5.156
0.825	2.167	1.100	2.217	1.550	2.373	2.000	2.655	2.450	2.937	3.470	3.504	5.250	4.339	7.050	5.175
0.830	2.168	1.110	2.221	1.560	2.379	2.010	2.661	2.460	2.943	3.510	3.523	5.290	4.358	7.090	5.193
0.835	2.168	1.120	2.224	1.570	2.385	2.020	2.667	2.470	2.949	3.550	3.541	5.330	4.376	7.130	5.212
0.840	2.169	1.130	2.227	1.580	2.392	2.030	2.673	2.480	2.955	3.590	3.560	5.370	4.395	7.170	5.230
0.845	2.170	1.140	2.230	1.590	2.398	2.040	2.680	2.490	2.962	3.630	3.579	5.410	4.413	7.210	5.249
0.850	2.170	1.150	2.234	1.600	2.404	2.050	2.686	2.500	2.968	3.670	3.587	5.450	4.432	7.250	5.268
0.855	2.171	1.160	2.237	1.610	2.410	2.060	2.692	2.510	2.974	3.710	3.616	5.490	4.450	7.290	5.286
0.860	2.171	1.170	2.240	1.620	2.417	2.070	2.698	2.520	2.980	3.750	3.634	5.530	4.469	7.330	5.305
0.865	2.172	1.180	2.243	1.630	2.423	2.080	2.705	2.530	2.987	3.790	3.653	5.570	4.488	7.370	5.323
0.870	2.172	1.190	2.247	1.640	2.429	2.090	2.711	2.540	2.993	3.810	3.671	5.610	4.506	7.410	5.342
0.875	2.173	1.200	2.250	1.650	2.435	2.100	2.717	2.550	2.999	3.850	3.690	5.650	4.523	7.450	5.360
0.880	2.173	1.210	2.253	1.660	2.442	2.110	2.724	2.560	3.005	3.890	3.708	5.690	4.543	7.490	5.379
0.885	2.174	1.220	2.256	1.670	2.448	2.120	2.730	2.570	3.012	3.930	3.727	5.730	4.562	7.530	5.398
0.890	2.175	1.230	2.260	1.680	2.454	2.130	2.736	2.580	3.018	3.970	3.746	5.770	4.580	7.570	5.416
0.895	2.175	1.240	2.263	1.690	2.460	2.140	2.742	2.590	3.024	4.010	3.764	5.810	4.599	7.610	5.435
0.900	2.176	1.250	2.266	1.700	2.467	2.150	2.749	2.600	3.031	4.050	3.783	5.850	4.618	7.650	5.453
0.905	2.176	1.260	2.269	1.710	2.473	2.160	2.755	2.610	3.037	4.090	3.801	5.890	4.636	7.690	5.472
0.910	2.177	1.270	1.273	1.720	2.479	2.170	2.761	2.620	3.043	4.130	3.820	5.930	4.655	7.730	5.490
0.915	2.177	1.280	2.276	1.730	2.486	2.180	2.767	2.630	3.049	4.170	3.839	5.970	4.673	7.770	5.509
0.920	2.178	1.290	2.279	1.740	2.492	2.190	2.774	2.640	3.055	4.210	3.856	6.010	4.692	7.810	5.528
0.925	2.178	1.300	2.282	1.750	2.498	2.200	2.780	2.650	3.062	4.250	3.875	6.050	4.710	7.850	5.546
0.930	2.179	1.310	2.286	1.760	2.504	2.210	2.786	2.660	3.068	4.290	3.893	6.090	4.729	7.890	5.565
0.935	2.180	1.320	2.289	1.770	2.511	2.220	2.792	2.670	3.074	4.330	3.912	6.130	4.748	7.930	5.583
0.940	2.180	1.330	2.292	1.780	2.517	2.230	2.799	2.680	3.081	4.370	3.930	6.170	4.766	7.970	5.602
0.945	2.181	1.340	2.295	1.790	2.523	2.240	2.805	2.690	3.087	4.410	3.949	6.210	4.785	8.010	5.620
0.950	2.181	1.350	2.299	1.800	2.529	2.250	2.811	2.700	3.093	4.450	3.968	6.250	4.803	8.050	5.639
0.955	2.182	1.360	2.302	1.810	1.536	2.260	2.818	2.710	3.099	4.490	3.986	6.290	4.822	8.090	5.658
0.960	2.182	1.370	2.305	1.820	2.542	2.270	2.824	2.750	3.118	4.530	4.005	6.330	4.840		
0.965	2.183	1.380	2.309	1.830	2.548	2.280	2.830	2.790	3.143	4.570	4.023	6.370	4.859		
0.970	2.183	1.390	2.312	1.840	2.554	2.290	2.836	2.830	3.168	4.610	4.042	6.410	4.877	Use ½ Thick	
0.975	2.184	1.400	2.315	1.850	2.561	2.300	2.843	2.870	3.193	4.650	4.060	6.450	4.896		

Table 1

The ratios and constants shown in this table are employed in the calculations for determining the areas or sizes of blanks for metal drawn parts. The ratios must first be found by dividing the thickness of the stock by the inside radius of the part. Then, from this dividend, the constant can be found from the table. As the table is arranged, various ratios and constants are opposite to each other

than the aforementioned parts. It is necessary to determine the neutral radius, center of gravity, length of arc and offset. When these factors are determined, the length of the neutral arc is multiplied by the diameter of the center of gravity and this result, when multiplied by 3.1416 will give the total area of stock required for this portion of the part.

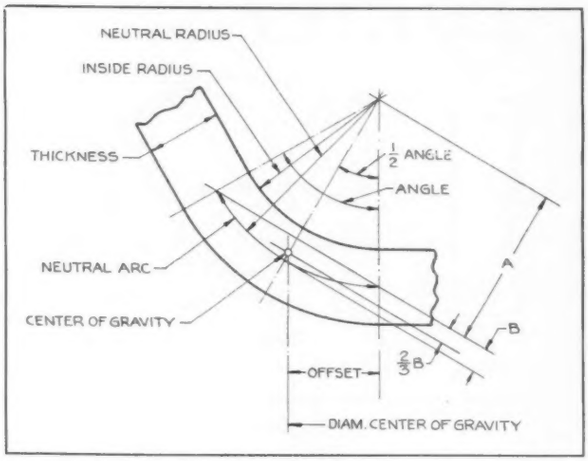


Figure 4

In the example shown above is the method for finding the size of a blank having corners of less than 90 deg. Here again is a case in which the formulæ are different from those used before

The final area is found by adding the results of all the calculations for the various portions, and then dividing the total sum by .7854 and extracting the square root of this result.

The foregoing is a short description of the method used for shells of uniform thickness throughout the part and for greater clarity the following detailed explanation is necessary.

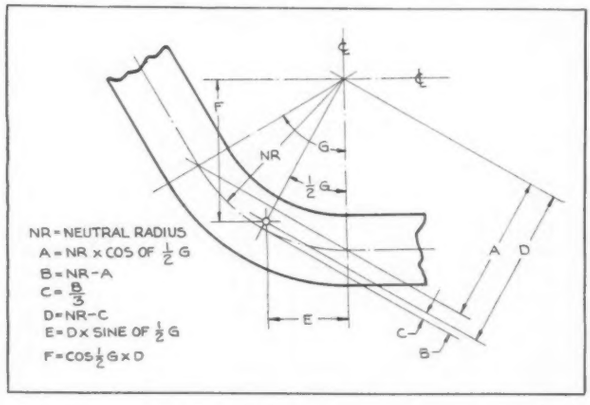


Figure 5

The data in this figure are used to locate the vertical and horizontal centers of gravity. In this example the drawn part has angles of 60 deg. instead of 90, as in other instances

The center of gravity in a cylindrical part, as shown, is estimated in the center of the wall. In other words, the inside diameter plus one thickness of stock (one-half on each side). This portion is calculated separately and added to the two other portions.

In drawn shells of this type the inside radius must be specified and the neutral radius is determined by the relation of the size of this inside radius to the thickness of stock as given in Table 1, Ratios and Constants.

To find the neutral radius for any of the listed ratios in the table, divide the arc by 1.5708 (for 90 deg. angles only).

The ratios above and below the largest and smallest figures in the table are handled as explained previously, by using the one-half or one-third thickness of stock.

The constants in the table, times the inside radius gives the length of the neutral arc of a 90 deg. angle.

The offset equals the distance from the outside diameter of the botom portion to the point of the center of gravity.

The offset is found by dividing the neutral radius by 1.5708 (for 90 deg. angles only).

The center of gravity for the radial portion is found by adding to the bottom diameter twice the offset.

The center of gravity of the radial portion will fall at a point two-thirds of the distance from the chord prescribed by the neutral arc, bisected by a half angle of 90 deg.

The diameter of the center of gravity of the radial portion is equal to the diameter at the points of the center of gravity in the radial part of the cylinder.

The circumference of the center of gravity is equal to the distance about a circle having a diameter equal to the diameter of the center of gravity.

The height equals the distance from where the radial portion ends to the top of the object.

The best method of explaining one of these problems is to develop a blank, using the method described at the beginning of this article. Such a blank is shown in Figure 2.

The Radial Portion

Stock thickness (.125) divided by the inside radius (.093) = 1.343 ratio.

Turning to the table we find listed opposite 1.343 the figures 2.295, or the constant for the ratio.

The inside radius (.093) times the constant (2.295) = .213, or the neutral arc.

The neutral arc divided by the constant for 90 deg. (1.5708) = .136, or the neutral radius.

The neutral radius (.136) divided by the constant for 90 deg. (1.5708) = .086, or the offset.

This is an example of the procedure followed in finding the size of the blank for a drawn metal part having tapered sides. In straight cylinders the center of gravity falls in the center, between the inside and outside diameters, while in tapered cylinders it is usually located midway between the smallest inside diameter and the largest outside diameter. In any of the calculations, however, the same ratios and constants shown in Table 1 are used for determining the size or area of the blank

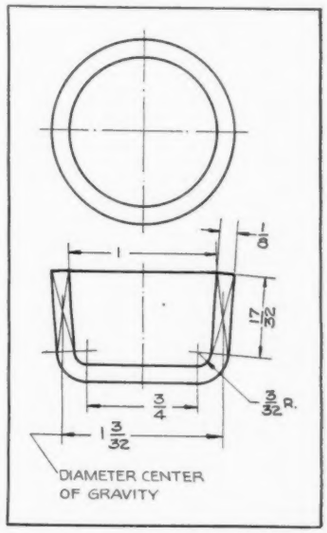


Figure 6

Twice the offset (.086) plus the bottom diameter (.437) = .609, or the diameter of the center of gravity.

The diameter of the center of gravity (.609) times (3.1416) = 1.913, or the circumference of the center of gravity.

(Continued on page 67)

What's NEMA Doing?

A department covering activities of the divisions, committees and sections of the National Electrical Manufacturers Association

Radio Course Compiled for Service Men

The first radio course for service men has just been compiled by the radio division of the National Electrical Manufacturers Association in cooperation with the Radio Institute of America, as the answer of national set manufacturers to the service problem.

The course comprises four text books. Four examination papers are offered during the course which may be submitted to the Radio Institute of America for correction and rating. Technical language has been avoided as much as possible, but fundamental principles, receiving circuits and circuit diagrams, receiving set components, definitions and ethics of servicing have been treated in sufficient detail to give the radio dealer and his service man an accurate understanding of all essential information required in practical service work.

The first book of the quartet comprises a brief outline of the fundamental principles of electricity involved in the process of broadcasting between the microphone of a broadcast transmitter and the loud speaker of a receiving set. It includes explanations of the definitions and standard radio symbols for all parts used in radio reception and required in servicing. General types of radio receivers, including tuned and untuned radio frequency, regenerative detector circuits, superheterodyne systems, and all types of audio amplifiers are treated, as well as the purpose, functioning and repairing of all the elements of standard power supply systems.

Book Two deals with direct current receivers and associated battery supply, continuity tests and how to make them, power supply rectifiers, filter systems, resistance bank or voltage divider; how to service B power units, what neutralizing is, why it is necessary and how to neutralize receivers of different types. It includes a detailed description of A. C. receivers with dynamic speakers; how to balance the radio frequency amplifier; how the operating voltages are obtained. Detailed description of commercial superheterodyne and how to adjust every part of it for maximum efficiency.

The third book deals with methods of handling the customer's service demands; common faults and troubles and how to identify them easily and quickly; trouble symptoms and their meaning. Vacuum tubes and how they function, grid leaks, grid leak receivers, why bias grid is used. Elimination of electrical interferences; how to locate sources of electrical noise and how to correct the various types of equipment which may cause interference with radio reception. How to make an installation which will pass the requirements of the Board of Fire Underwriters.

The last volume contains complete circuit diagrams of all the leading models and makes of radio receivers on the market. This handbook alone is worth the entire cost of the course, and is the first encyclopedia of radio circuits to aid the service man in the application of practical service methods explained in the previous three texts. Inquiries may be addressed to the Radio Institute of America, 326 Broadway, New York City.

A. Penn Denton Completes National Code Tour

A. Penn Denton, engineering director of the armored conductor and flexible metallic conduit section, Nema, has just returned from a tour of ten Western cities, where he addressed all electrical groups interested in national code development. Mr. Denton's trip took him to Denver, Salt Lake City, Spokane, Vancouver, Seattle, Portland, San Francisco, Los Angeles, Oakland, and San Diego.

Special meetings of the representatives of all branches of the industry were called in each city. In his addresses Mr. Denton stressed the value of the National Electrical Code, outlining its history and the need for a standard minimum code upon which the ordinances of all cities may be based. In that connection he discussed the additional rules regulating wiring methods which are required by cities because of different types of occupancy.

He urged an open mind on the part of inspection departments as to methods of wiring within well-defined limitations. He cautioned against too rigid application of regulations which would prohibit use of wiring materials long established and found to be economically justifiable in wiring. He also spoke of the general desire of manufacturers of wiring materials for standardization looking toward improved service and lower costs, and pledged sympathetic and constructive policies on their part to maintain a healthy development of the wiring market.

High Voltage Insulator Section Formed in Nema

Representatives from interested insulator companies were present at the organization meeting of the high voltage insulator section of Nema.

Stewart N. Clarkson, who presided, stated that the board of governors of Nema had placed the facilities of the association at the disposal of the insulator manufacturers by authorizing the organization of a high voltage insulator section.

The charter membership of the newly organized high voltage insulator section, under the chairmanship of J. S. Lapp of the Lapp Insulator Co., Inc., includes the following: Lapp Insulator Co., Inc., Le-Roy, N. Y., J. S. Lapp, executive; Ohio Brass Co., Mansfield, Ohio, G. L. Draffan, executive; R. Thomas & Sons Co., East Liverpool, Ohio, H. R. Holmes, executive; Locke Insulator Corp., Baltimore, Md., F. H. Reagan, executive; Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa., G. I. Gilchrist, associate.

Transmitter Section Advises Radio Commission

A special meeting of the transmitter section of the radio division, Nema, was called by its chairman, Julius Weinberger, in order to formulate a reply to a series of technical questions on broadcast allocation problems, submitted by Dr. J. H. Dellinger, chief engineer for the Federal Radio Commission.

Among the points on which definite technical recommendations were made, were the subjects of synchronization of broadcast carrier frequencies, location of stations near congested centers, requirements of dummy antenna by stations operating on time-sharing basis, ratio of day to night power, and the number of cleared channels for most satisfactory nation wide service.

Board of Governors Approves New Lighting Sections

The Nema board of governors has approved the recommendations of the membership committee that three additional lighting sections be organized in the lighting division, as follows:

Exterior lighting section, to include groups of floodlighting manufacturers, airport lighting manufacturers and possibly at some future date a traffic lighting group; commercial lighting section, to include window lighting and interior lighting manufacturers; electric sign section, to include manufacturers of electric signs.

The board also reconsidered its previous action in putting the different furnace manufacturers into one section, and organized the organization of three sections as part of the industrial heating division, as follows:

Resistance type furnace section (now organized and functioning); melting furnace section; industrial oven section.

The Attachment Plug Section has unanimously voted in favor of the compilation of statistics by the section. These statistics will be furnished in units and not in dollar value, and will be arranged by the statistician at Nema headquarters.

Motor Rewinding Costs

In response to numerous requests for information relating to the various costs of rewinding electric motors the following information has been compiled from information obtained from repair shops throughout the country

By D. H. Braymer
Consulting Engineering Editor
Electrical Manufacturing

DETAILED information on the cost of rewinding and repairing two and three phase, 60 cycle, induction motors of 110 to 550 volts, was presented by the writer in his book, "Armature Winding and Motor Repair," published in 1919. Since that time numerous requests have been received for revised information based on present-day prices. With the cooperation of the editors of Electrical Manufacturing, detailed price schedules covering rewinding and repairs have been obtained from 42 motor repair shops, located in 21 states of this country. The distribution is as follows: 3 in New York, 1 in New Jersey, 1 in Connecticut, 1 in Rhode Island, 2 in Massachusetts, 3 in Pennsylvania, 3 in Virginia, 1 in Georgia, 1 in Tennessee, 2 in Texas, 1 in Arkansas, 1 in Oklahoma 5 in Ohio, 3 in Indiana, 4 in Illinois, 1 in Michigan, 4 in Minnesota, 1 in South Dakota, 2 in Colorado, 1 in Utah, and 1 in Washington.

In what follows an analysis will be given in tabulations and in curves for ready reference in checking existing rewinding costs and for use in making new schedules. These new data apply to squirrel cage induction motors, two and three phase, 60 cycle, 110 to 550 volts with modifications as outlined to cover variable speed, slip ring motors and 2300 volt motors.

For reference in this connection, Table I is reproduced from the book, "Armature Winding and Motor Repair," based on costs as of 1917. This information is given for the reason that it was secured from an analysis of a large number of rewinding jobs and represents the average of carefully prepared cost data. The costs as shown in Table I were compiled for a given motor frame and modified as required for the various ratings built in the same frame

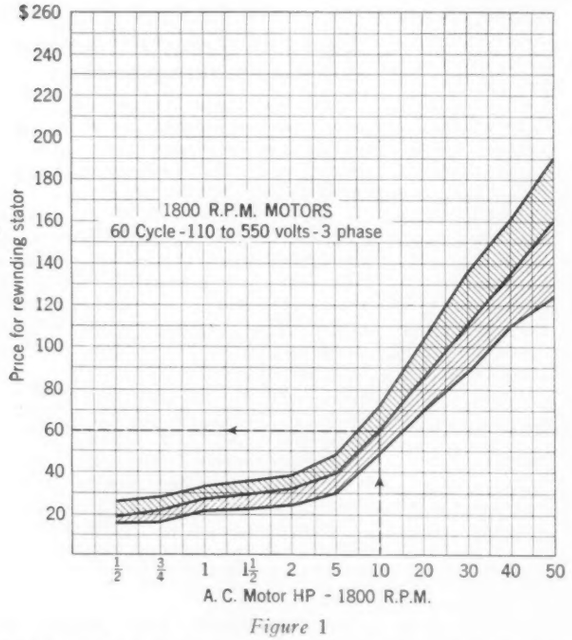


Figure 1

This chart gives the prices for rewinding stators of A. C. motors of 60 cycles—3 phase—110 to 550 volts at 1800 r.p.m. The data from which this chart was made was submitted by motor repair shops in all sections of the country and represents current prices

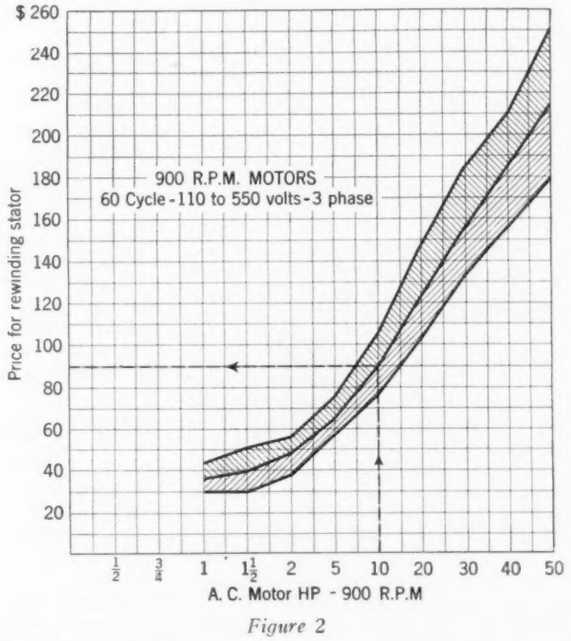


Figure 2

This chart is similar to that in Figure 1, in that it shows the various current prices being charged throughout the country for rewinding A. C. motors of 60 cycles—3 phase—110 to 500 volts at 900 r.p.m. Mean figures are shown by heavy line

as 40 deg. designs. For example, the cost of rewinding the stator of frame G is given as $34.75 for 1 hp., 900 rpm.—1.5 hp., 1200 rpm.—2.0 hp., 1200 rpm.—and 3.0 hp., 1800 rpm. These frame sizes as listed in Table I do not refer to any particular make of motor, but follow the plan as mentioned; namely, the same frame used for the different ratings and speeds. These data can be used as modified by the new information presented for estimating the rewinding price of motors of other than 60 cycles when the other frequencies are built in the same 60 cycle frames. This can be determined by referring to the manufacturer's ratings and their dimension sheets for a particular type of motor.

It is also possible to use this tabulation in Table I as modified by the curves and other new data as prestented in this article, for determining the price to be charged for rewinding variable speed, slip ring motors. In a well equipped shop employing experienced winders, the cost of rewinding the rotor of a slip ring induction motor will not be very much different than the cost of rewinding the stator. In the case of a 10 hp., 1800 rpm., slip ring motor, the cost of rewinding the stator or the rotor in frame J is given as $59.50 or $119.00 for the cost of rewinding both. From the curves in Figure 4, which are to be used in modifying the costs of Table I, there is not much change in this cost, since the price for rewinding the stator of a 10 hp., 1800 rpm. motor as taken from the curve of Figure 4 is $60.00, so that the revised cost of rewinding both the stator and rotor of this motor based on the average of present-day prices would be $120.00.

The range of prices for rewinding stators of induction motors as furnished in the 42 price schedules received has been plotted in three curves in Figures 1, 2 and 3 for motors of 1800, 1200 and 900 rpm. The heavy lines in these curves are the average of the prices as presented, while the shaded section shows the range of prices above and below these average values, as given for the different sections of the country. The curves in Figure 4 have been plotted from the average values in Figures 1, 2 and 3, and these curves are the ones to be used in modifying the data of Table I. The data showing range of prices in Figures 1, 2 and 3 will be useful in establishing prices where competition or other conditions are factors controlling price schedules. From these curves it is certain that when the average shop is charging less for the rewinding of stators than shown in the shaded areas of Figures 1, 2 and 3, the profit from this class of work is being reduced below a reasonable figure, and so the price schedule in that case should be revised upward rather than attempt to hold the price down and skimp on the grade of insulation or the varnish insulation that is required. A quality rewind job properly dipped and baked in a good grade of insulating varnish as required for the service demanded of the motor is worth an adequate price, and this price should be obtained. Details of proper varnish insulation and the application of insulating materials have been given in other articles by the writer in the 1928 issues of Electrical Manufacturing.

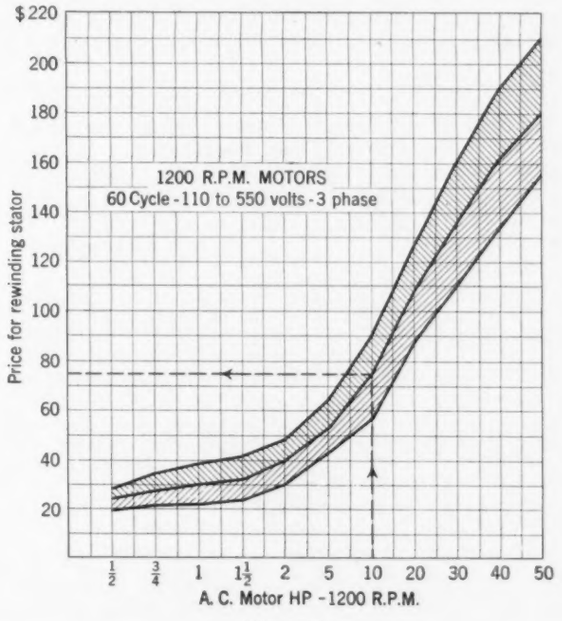


Figure 3

Here again is another chart made up in the same manner as those in Figures 1 and 2. It shows the cost of rewinding A. C. motors of 60 cycles—3 phase—110 to 500 volts at 1200 r.p.m. Shaded portions show high and low average cost variations

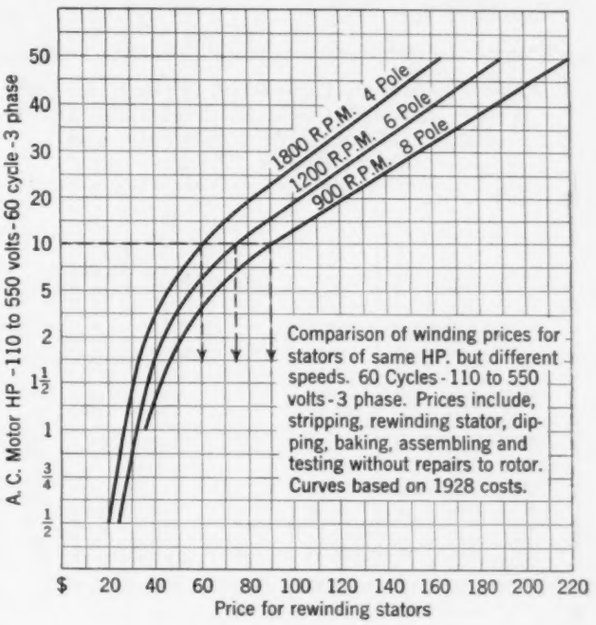

50
40
30
20
10
5
2
1½
1
¾
½
A. C. Motor HP - 110 to 550 volts - 60 cycle - 3 phase
1800 R.P.M. 4 Pole
1200 R.P.M. 6 Pole
900 R.P.M. 8 Pole
Comparison of winding prices for stators of same HP. but different speeds. 60 Cycles - 110 to 550 volts - 3 phase. Prices include, stripping, rewinding stator, dipping, baking, assembling and testing without repairs to rotor. Curves based on 1928 costs.
$ 20 40 60 80 100 120 140 160 180 200 220
Price for rewinding stators

Figure 4

This chart gives the comparisons between the different costs of winding motors of the same horsepower but of different speeds. Prices include stripping, rewinding stator, dipping, baking, assembling, and testing without any repairs to the rotors

The prices in Table I and those of the correction curves in Figure 4 do not include special work that may be required on a motor stator in order to get it into condition for the rewinding job. This extra work should be handled on a time and material basis and added to the rewinding costs as indicated in the tables and curves.

For example, a motor may be received in which the bearing linings have worn down sufficiently to allow the rotor to rub on the stator, and as a result the laminations of both the stator and the rotor may be damaged. The work of repairing these laminations, such as restacking, and the like, is a proper extra charge on a time and material basis. Bent shafts that must be straightened or new shafts are also extra charges not included in the rewinding prices. In 11 of the 42 price schedules received, it was stated that the cost of painting the stator and recrating for shipment was included in the stator rewinding price. This is not considered as good practice because these costs do not bear any relation to the cost of rewinding the stator, and could be more profitably handled as a separate charge, when making up the total price of the repairs to be done. In the 42 price schedules, 14 companies make separate

charges on a schedule basis for welding or brazing rotor bars, while 13 companies do this work on a time and material basis, and 3 do it on a percentage of the stator rewinding price. This percentage ranged from 15 to 20 per cent of the stator rewinding price.

At best a definite and final price schedule for a complete rewinding and repair job is a difficult thing to accomplish because the horsepower rating of the motor, its frame size and the design and arrangement of the windings vary with each manufacturer and call for careful inspection by an experienced repair man before a satisfactory repair price can be established. It is for this reason that any price schedule should be made up of independent charges for the work that is required. This is especially true of motors of special speeds, and old designs for which special coils must be made. In these cases the time and material basis is the safest plan to use in rendering a repair charge fair to the repair shop and fair to the customer.

Table I—Stator Rewinding Prices for 60 Cycle, 2 and 3 Phase Squirrel Cage Induction Motors 110 to 550 Volts and Other Repair Charges

Horsepower	Synchronous Speed—R.p.m.	Frame Size	Rewinding Stator	Welding Roator Bars	Bearing Linings Per Set of 2	Painting Frame	Crating
0.5	1200	C	$26.25	$2.50	$1.35	$1.00	$1.00
0.5	1800	A	24.25	2.25	1.35	1.00	1.00
0.75	1200	E	28.00	3.00	1.85	1.00	1.00
0.75	1800	B	24.25	2.25	1.35	1.00	1.00
1.0	900	G	34.75	4.00	3.10	1.50	1.00
1.0	1200	F	28.50	3.00	1.85	1.25	1.00
1.0	1800	C	26.25	2.50	1.35	1.00	1.00
1.5	1200	G	34.75	4.00	3.10	1.50	1.00
1.5	1800	E	28.00	3.00	1.85	1.00	1.00
2.0	1200	G	34.75	4.00	3.10	1.50	1.00
2.0	1800	F	28.50	3.00	1.85	1.25	1.00
3.0	900	I	53.50	6.50	5.25	1.50	1.50
3.0	1200	H	48.50	6.75	3.55	1.50	1.50
3.0	1800	G	34.75	4.00	3.10	1.50	1.50
5.0	900	K	73.75	8.75	8.05	1.75	2.00
5.0	1200	I	53.50	6.50	5.25	1.50	1.50
5.0	1800	H	48.50	4.75	3.55	1.50	1.50
7.5	900	L	70.75	12.00	7.85	2.00	2.50
7.5	1200	J	59.50	7.00	6.60	1.75	2.00
7.5	1800	I	53.50	6.50	5.25	1.50	1.50
10.0	900	M	75.00	13.25	7.85	2.00	2.50
10.0	1200	L	70.75	12.00	7.85	2.00	2.50
10.0	1800	J	59.50	7.00	6.60	1.75	2.00
15.0	720	P	93.75	15.50	10.25	3.00	4.00
15.0	900	N	71.25	14.25	10.25	3.00	4.00
15.0	1200	M	75.00	13.25	7.85	2.00	2.50
15.0	1800	K	73.75	8.75	8.05	1.75	2.00
20.0	600	S	156.25	19.00	12.10	3.25	6.00
20.0	900	P	93.75	15.50	10.25	3.00	4.00
20.0	1200	N	71.25	14.25	10.25	3.00	4.00
20.0	1800	M	75.00	13.25	7.85	2.00	2.50
25.0	600	S	156.25	19.00	12.10	3.25	6.00
25.0	720	S	156.25	19.00	12.10	3.25	6.00
25.0	900	R	143.75	17.75	12.00	3.25	6.00
25.0	1200	P	93.75	15.50	10.25	3.00	4.00
30.0	600	T	187.50	20.50	19.95	3.50	6.25
30.0	720	S	156.25	19.00	12.10	3.25	6.00
30.0	900	S	156.25	19.00	12.10	3.25	6.00
30.0	1200	R	143.75	17.75	12.00	3.25	6.00
50.0	600	V	218.75	21.75	30.85	3.50	6.25
50.0	720	V	218.75	21.75	30.85	3.50	6.25
50.0	900	T	187.50	20.50	19.95	3.50	6.25
50.0	1200	S	156.25	19.00	12.10	3.25	6.00

NOTE: This tabulation was originally compiled by George A. Schneider and has been reproduced from Armature Winding and Motor Repair, by D. H. Braymer. It is based on the cost of rewinding the same frame size for the different horsepower ratings and speeds. These prices are based also on costs as of 1917 and can be modified for present day costs by the use of the curves in Figure 4.

Table 1

The data contained in this table were compiled for a given motor frame and then modified as required for different horsepower ratings built in the same frame. A full explanation of the use of these data will be found elsewhere in this article

In view of the remarks regarding special work that may be required in connection with a rewinding job, the following comments are offered as an aid in arriving at adequate and fair charges for this special work.

The information in Table II shows the average charges from the price schedules received, covering welding and brazing of rotor bars, replacing bearing linings, painting stators and recrating the motor for shipment.

When a motor has been badly overheated, the connections of rotor bars to end rings may be seriously weakened. In such cases new end rings may be needed for one or both ends of the rotor, and perhaps some new bars may be required. This work is a time and material job. In those cases, however, where motors have been started from time to time under heavy loads requiring long periods of acceleration, or where three phase motors have been allowed to operate single phase, the end connections to rotor bars and end rings can be repaired by welding or brazing, and for this charge a price schedule can be set up as shown in Table II. These charges are for welding or brazing all end connections on both ends of the rotor, so that the price for repairing a few bars or end connections can be arrived at by dividing the total charge by the number of end connections on both ends of the rotor and obtaining a charge for each connection that is made. The cost of using an acetylene welding outfit for this work, turning and rebalancing the rotor when all end connections are rewelded, will range from 15 to 20 per cent of the stator rewinding price, as shown in the curves of Figure 4. These percentages can be used when an approximate estimate is required and the charge made on a time and material basis. In the larger motors 20 per cent of the 1800 rpm. stator rewinding price is a good basis, when a trained welder does the job.

Table II shows the average charges made by the companies furnishing price schedules for this work. In one case the cost per bearing, including the taking out of the old bearing and installing a new one, is estimated at 7½ to 10 per cent of the stator rewinding price. In another case the charge for a set of bearings is 10 per cent of the stator rewinding price up to 20 hp. rating and 15 per cent for motors above 30 hp. Three companies invoice this work at the list price of the bearings as purchased.

Table II—Average Repair Prices for Work Other Than Rewinding

H.P. Rating	Welding or Brazing Rotor Bars	Bearing Linings Per set of 2	Painting Frame	Crating for Shipment
½ to 2	$3 to $5	$3 to $6	$1.50	$1.00
5	$6.00	$8.00	1.50	1.50
10	12.00	12.00	2.00	2.00
20	15.00	18.00	3.00	3.00
30	18.00	22.00	4.00	4.00
40	20.00	26.00	5.00	5.00
50	25.00	30.00	5.00	6.00

Table 2

Since there are many other factors entering into the cost of repairing electric motors, these are taken into consideration in this table. Motors are listed from ½ to 50 hp., and the costs include painting, packing, welding, and the like

For rewinding the rotor of variable speed slip ring motors, the usual charge is the same as for rewinding the

(*Continued on page 69*)

Waxes and *Insulating Compounds* for Use in the Electrical Industry

In the form of waxes and different compounds there are quite a number of insulating materials used in the electrical industry and each of them has its own peculiarities, requiring the use of good judgment in its various applications

No. 11 of a Series of Articles on Common Materials

By William Crawford Hirsch

SATURATING and finishing waxes as well as sealing and filling compounds constitute a class of insulating materials that are so important that they may be characterized as furnishing in many electrical products the manufacturer's first line of defense against the constant warfare made upon uninterrupted service by atmospheric moisture and kindred deteriorating influences. Trade usage has broadened the classification of waxes to include, in addition to the primary animal, mineral and vegetable substances known by that designation, a large number of bituminous substances, such as asphalt and pitches. Most important from the point of view of electrical consumption among these materials is paraffin, the solid constituent of petroleum distillates. While a good deal of animal, mineral and vegetable wax finds employment in electrical manufactures, most of it is marketed in the form of compounds specially blended to obtain those properties that are required in particuliar uses. The primary hydrocarbons of commerce lack, as a rule, certain properties for insulating purposes, and these are supplied by introducing substances that have been found to overcome these shortcomings. Hence, the electrical manufacturer's task in providing the most efficient material for insulating and finishing rubber-covered and weatherproof wire and for sealing batteries, coil boxes, etc., resolves itself chiefly into preparing explicit specifications, so that the compounder may know exactly what properties he must strive for in combining the raw materials at his disposal, as the proportion in which they are mixed has a direct bearing on their behavior during application and their electrical and physical properties after drying.

USUALLY in the application of the various waxes and other compounds used in electrical products as insulating materials the different manufacturers supply specifications in which recommended practices are described in detail. Therefore, and in order that best usage may be made of any insulating material, it is always best for the electrical manufacturer to consult with the maker of the compound or wax to insure that he fully understands its properties and applications. In this manner best results will be obtained and possibilities of failure in service will be practically eliminated

The oldest of all waxes and the one first thought of when wax is mentioned is the product of the honey bee, a more or less plastic, fatty solid which comes on the market in varying shades of yellow and can be bleached white. It has a melting point of 145 to 148 deg. Fahr. and a specific gravity of 0.964 to 0.970. It is used electrically to impregnate small coils so as to exclude moisture and for boiling out cable forms, cores, etc. The American market's needs are virtually all covered by importation, especially from Santo Domingo, Porto Rico, Portugal, Brazil, Chile, and parts of Africa. The crude wax contains much in the way of impurities, a factor that must be taken into consideration in comparing the price of the crude with that of the refined wax. Beeswax finds considerable use in certain insulating compounds, its plasticity and tackiness being highly valued to offset the tendency of certain mineral waxes to crumble. It is the highest in the per pound price of the ordinary waxes of commerce.

Among the vegetable waxes candelilla, found as an excretion on certain Mexican shrubs and is extracted by boiling in steam tanks, is used in insulating compounds for wires. The candelilla plant yields a dark brown wax which is refined to a brownish yellow that ranges from opaque to translucent. It has a melting point of 152 to 154 deg. Fahr. and a specific gravity of 0.983, being harder than beeswax.

Still greater hardness is shown by carnauba wax, a yellowish or brownish gray substance obtained from the leaves of the Brazilian carnauba palm. It is almost brittle and its outstanding quality is the fine polish which it imparts. Its melting point is 183 to 186 deg. Fahr. and its specific gravity 0.990 to 0.999. It finds wide use in many insulating compounds, especially when a shining, lustrous surface is desired. Some of the finer grades sell at prices very close to those for beeswax. The carnauba wax market is subject to wide fluctuations due to its semi-speculative character.

Among the mineral waxes, ozokerite and ceresine, the latter being the refined product of the former, must be mentioned first. Ozokerite occurs in nature in the form of veins and fissures as the result of the conversion of animal remains into hydrocarbons, being mostly found as-

sociated with petroleum. Boryslaw, Polish Galicia, is usually pointed to as the seat of the principal deposits, the mineralogical theory being that these were formed during the transformation of animal remains into petroleum. Purity and melting point of the various deposits embrace a wide range, some yielding a soft and others a brittle earth wax varying in color from a greenish brown to black. The melting point of ozokerite is 130 to 185 deg. Fahr. and its specific gravity from 0.850 to 0.950. The refining process consists of treatment with strong sulphuric acid, followed by filtration in a melted condition through animal charcoal. The resulting ceresine is white and is marketed either in the natural bleached form or colored yellow, orange, etc. Ceresine as well as ozokerite are used in different insulating compounds, especially so in compositions for the insulation of cable.

The Preparation of Paraffin

PARAFFIN, the leading insulating wax, in the form that it is chiefly used for electrical purposes, is a derivative of the Asiatic petroleums, sometimes referred to as Rangoon oil, which produces the highest melting point, ranging in the crude up to 128 deg. Fahr. and in the refined up to 140 deg. Fahr. Paraffin is split from the petroleum at the fourth fraction, gasoline, kerosene and gas oil having been separated previously in the sequence in which they are named. By means of chilling, filtering, sweating, and agitating the paraffin wax is segregated and refined, finally being molded into cakes. Less important sources from which paraffin may be derived are in the distillation of shale oil or the treatment of lignite tar.

Aside from its use in the insulation of wire cables, paraffin enters more or less into virtually every compound and also finds wide employment in battery assembling operations.

Bermudez asphalt, obtained from the Bermudez Pitch Lake in Venezuela, and that found in the nearby British island of Trinidad are among the natural bitumens that come in for considerable use in insulating compounds. In the manufacture of telephone condensers the units of paper and tin foil, after they have been treated with a paraffin compound, are dipped in an asphalt mixture which enhances the condensers' resistance to heat and cold. In fact, after a protective coating of a compound has been applied, many wires and coils are given an additional armor of an asphalt preparation when severe moisture conditions must be met. Gilsonite, manjak, grahamite, etc., are asphaltite variations. Besides these native asphalts, so-called "blown" asphalts are obtained through oxidation of the residual oils in the steam distillation of petroleums. These are sometimes referred to as "mineral rubber," being especially suitable for compounding with rubber. These "mineral rubbers" serve as the most economical of compounding ingredients in insulating materials.

A large variety of pitches are derived as by-products in the manufacture and refining of fatty acid products, such as soap, candles, vegetable oils and greases. Some of these fatty acid pitches have properties that make them valuable ingredients in insulating compositions.

Saturating waxes must be of low viscosity and medium melting point as well as capable of completely penetrating the braid at temperatures of from 210 to 300 deg. Fahr. in a reasonable length of time. They must be as hard as possible so as not to soften the subsequently applied finishing coat. Rubber-covered wire is saturated by drawing it through a bath of molten wax, the wire usually remaining in the bath from 5 to 15 seconds. Saturation takes place in proportion to the heat of the bath which is accordingly regulated. After the surplus wax has been wiped from the wire, it is reeled. Usually a day is permitted to elapse between saturating and finishing, the latter being carried out much in the same manner as the former. The finishing wax is kept at a relatively low temperature and the operation conducted at as high a speed as possible, so as to lessen the risk of the saturating compound softening the finishing coat. After the finishing wax has become cool, the wire's surface is smoothed and polished by drawing through close-fitting steel dies.

Combination saturating and finishing compounds for carrying out both processes in one operation on rubber-covered wire are available. These compounds consist usually of asphalt and paraffin mixtures, hardened with carnauba, montan and other waxes.

Saturating compounds for weatherproof wire, on the other hand, consist largely of petroleum pitch residues mixed with wax tailings or pine tar, the latter acting as quasi-solvents for the former quasi-solids. Compounders say that the demand for heavy saturating compounds for weatherproof wire, which is sold by weight, frequently leads to trouble. Unless a proper balance between the quasi-solids and quasi-solvents is maintained, trouble in saturating as well as defective insulation are bound to ensue. Weatherproof wire is saturated on iron reels lowered into the tank in which steam coils keep the compound at a temperature of from 300 to 350 deg. Fahr., saturation being completed in ten to fifteen minutes. Finishing is carried out in the same manner as on rubber-covered wire.

Applications of Filling Compounds

FILLING and pothead compounds consist mostly of hydro-carbon combinations marketed under proprietary names. These compounds must conform with the rules of the National Electrical Safety Code regarding melting points and must be uniformly constant with reference to viscosity, penetration, specific gravity, moisture absorption, dielectric strength, etc. Uniform flow point maintained under continued heat is highly important. Adherence to porcelain is another important consideration, especially in the back of standard cut-out bases. For filling in between the leads and porcelain bushings in transformers, so as to produce an oil-tight joint, compounders market a mixture with a "specially treated gum" as base. In this connection it may be well to state that Chatterton compound, frequently mentioned in European literature, consists of gutta percha, tar and rosin, made up in ½ and 1-pound sticks.

Compounds for impregnating armatures and coils under vacuum pressure are graded according to melting point and the size and character of the windings to be impregnated.

Medium grades of rosin serve as the chief material in dry cell sealing compounds. They are usually hardened by treating them with lime. A mineral filler is used. This type of sealing compound, because of its economy, has completely displaced the use of shellac. Special attention is paid to the color of sealing compounds for dry cells, as these are looked upon as one of the important distinguishing features by which consumers recognize their favorite make. Dry battery sealing compounds melt at approximately 200 deg. Fahr. and are worked at between 250 and 300 deg. Fahr. when they pour readily and fill efficiently the battery interstices. For switch, socket and panel work the same compound is used, being usually cast into stick form and then used as solder with an electrically heated soldering iron. Specially hard compounds have been developed for sealing screw heads, nuts, bolts and other live parts of electrical fittings and for filling large dry batteries.

For the sealing of storage batteries acid-resisting asphalt-pitch compounds are used, special precautions being taken in their preparation to insure their resistance to extreme temperatures. These sealing compounds are marketed in both black and colors.

It will be seen from the foregoing that the compounding of these waxy bodies for insulating purposes calls for much in the way of specialized knowledge regarding their characteristics and behavior in electrical service.

Characteristics That Determine the *Selection* of MOTORS

No. 11 of a Series Discussing Motors of Different Types

Under the heading of variable speed motors there are three distinct types, each of which has certain characteristics that will be discussed in this series

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VARIABLE speed motors may be defined as those motors which have a wide range of speed variation governed only by the control used and the nature and requirements of the loads which these motors drive. There are some limitations to this statement but in general, the speed may be adjusted to any desired value. The maximum of flexibility is obtained in a motor of this kind, but it is sometimes offset by disadvantages as will be seen later.

Under the division of variable speed motors, there are three quite distinct types which we will discuss.

1—The slip ring induction motor.

2—Direct current shunt and compound wound motors designed for field or armature control.

3—The alternating current brush shifting motor.

In the October, 1928, issue of ELECTRICAL MANUFACTURING, the slip ring motor was considered from the standpoint of constant speed applications. It will now be considered from the standpoint of its variable speed characteristics and applications.

General:—Before proceeding with the discussion of the variable speed characteristics, it would be well to bring out more clearly the general characteristics of the slip ring motor as compared to other types of induction motors.

In the October, 1928, issue of ELECTRICAL MANUFACTURING, mentioned above, the slip ring motor was discussed from the standpoint of mechanical and electrical features differing from the squirrel cage induction motor. Figure 25 of the same issue showed the rotor construction and Figure 26 the characteristics of a small slip ring motor with short circuited secondary. A further analysis of the slip ring motor will enable the reader to understand, in a more complete manner, just what may be accomplished through the use of this type of motor.

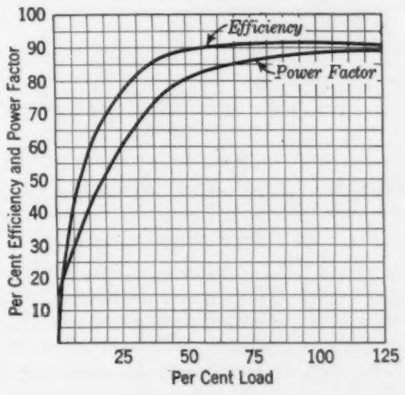


Figure 1

This chart shows the efficiency and power factor characteristics of a 100 hp., 1200 r.p.m. slip ring induction motor at different load percentages

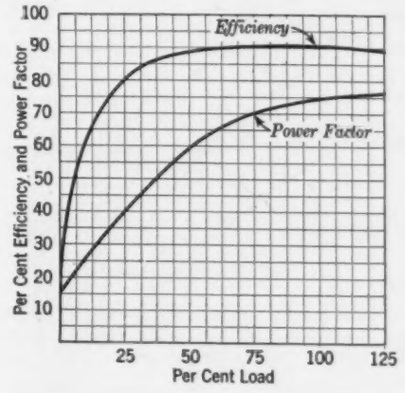


Figure 2

This chart is similar to that shown in Figure 1 in that it shows the same characteristics for a 100 hp. slip ring induction motor operating at a speed of 450 r.p.m.

In general the efficiencies and power factors of a standard line of slip ring induction motors will be somewhat less than those of a standard line of squirrel cage induction motors due to the differences in construction mentioned above. However, the loss in efficiency and power factor is not so large as to become the deciding factor in influencing the motor drive for a particular application.

The efficiency and power factor of a 100 hp., 1200 r.p.m. slip ring induction motor operating at its normal full load speed is shown in Figure 1. It will be seen that these characteristics compare favorably with the squirrel cage induction motor. See in ELECTRICAL MANUFACTURING for June, 1928.

Figure 2 shows the efficiency and power factor of a 100 hp., 450 r.p.m. slip ring induction motor, making the same

comparison as above; these characteristics also compare favorably with the squirrel cage motor. While the slip ring motor characteristics are slightly lower, it must still be conceded that this basis alone is not sufficient to decide the application. Comparing Figures 1 and 2 shows that the

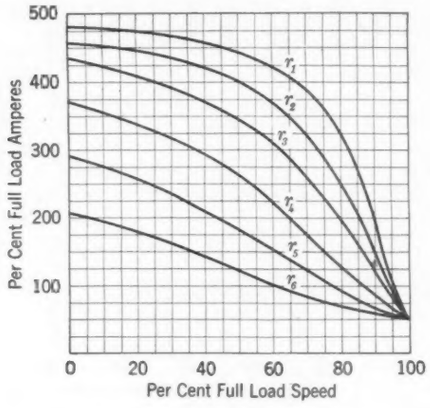


Figure 3

Another chart showing the inrush current of a slip ring elevator motor with different values of resistance inserted in the rotor or secondary circuit

power factor of the 450 r.p.m. motor is considerably less than that of the 1200 r.p.m. motor. So here again, as in the case of the squirrel cage induction motors, we must draw the same conclusion, namely, that the slip ring induction motor suffers a loss of characteristics at slower

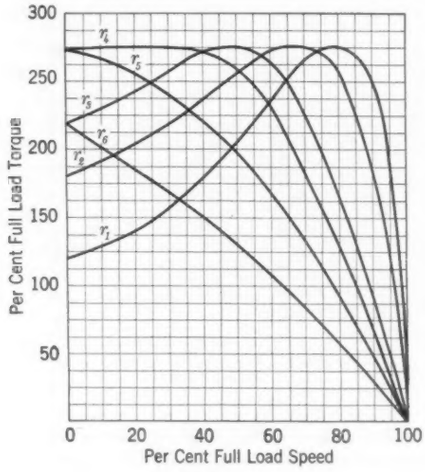


Figure 4

A chart showing the starting and maximum torques of a slip ring motor with different values of resistance inserted in the rotor or secondary circuit

speeds that is detrimental and that below 450 r.p.m. this motor rapidly becomes too uneconomical for the user. This is an inherent characteristic to be found in all types of induction motors.

Figure 3 shows the inrush currents drawn from the line by a slip ring elevator motor with different values of resistance inserted in the rotor or secondary circuit. This test was made using six different values of resistance as indicated on the curve. These curves simply indicate what may be accomplished in the way of varying the starting currents. Obviously, by using a standard slip ring controller with a large number of resistance steps, the inrush could have been varied anywhere between these limits or even reduced further if it was desirable.

Figure 4 shows the starting and maximum torques of this same slip ring motor with the same six different values of resistance inserted in the secondary circuit. It will be noticed that the torque at starting increases as the resistance is increased until it reaches the value of r, and then begins to fall off. It is near this point where the resistance inserted is greater than the critical rotor resistance that the maximum torque as well as the starting torque begins to fall off. These curves give a very good picture of what may be accomplished in this type of motor at starting.

Variable Speed Characteristics:—While the flexibility of speed control of the slip ring motor is in itself a distinct advantage, still there are disadvantages which should be investigated for any particular application—lack of stability is one of the distinct disadvantages. Unless the load is to be fairly constant, it would be well to consider another type of motor? Suppose that during a certain part of its duty cycle a slip ring motor would be operating at some fraction of its normal full load speed and driving a certain load. This condition of operation could be obtained by inserting the proper resistance into the secondary circuit through the use of the controller. However, if this load fluctuated the motor would have a tendency each time the load became less to return to its normal full load speed. The result of a fluctuating load then would be a fluctuating speed on the motor drive which would probably not be satisfactory for the performance of the duty for which the machine driven by the motor was intended. A good example of this was the punch press drive mentioned in the January, 1929, issue of Electrical Manufacturing and shown in Figure 15 of that issue.

It should be mentioned, however, that the slip ring motor is satisfactory for many drives where the load is constant. Among these applications are:

1—Centrifugal pump drive.
2—Elevator service.
3—Crane and hoist operation.
4—Fan drive.
5—Conveyor systems.
6—Rubber mill drive.
7—Cement mill drive and many other similar applications.

When considering the slip ring motor for any variable

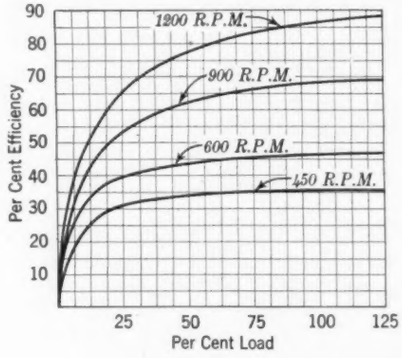


Figure 5

A chart showing the efficiency of a slip ring motor operating under the same conditions as a multi-speed squirrel cage induction motor, but at different speeds

application it would be well to consider its characteristics, not only for normal full load speed operation, but also for the range of speed variation through which the motor may be expected to operate. We will attempt to explain this point by a comparison between the characteristics of the 7.5 hp. multi-speed squirrel cage induction motor discussed in the December, 1928, issue of Electrical Manufacturing, and a slip ring induction motor, also rated 75 hp. (constant hp.) with the speeds below 1200 r.p.m. obtained by inserting resistance in the rotor circuit.

Estimating Blank Sizes

(*Continued from page* 58)

The circumference of the center of gravity (1.913) times the neutral arc (.213) = .407, or the area of the radial portion.

The inside diameter (.625) plus one stock thickness (.125) = .750, or the diameter of the center of gravity.

The diameter of center of gravity (.750) times π (3.1416) = 2.356, or the circumference of the center of gravity.

The circumference of the center of gravity (2.356) times the height (.531) = 1.251, or the area of the cylindrical portion.

The Circular Bottom Portion

The area of the bottom equals the area of a .4375 diameter circle, or .1503.

The total area and diameter of blank.

.1503 = Area of bottom
1.2510 = Area of cylindrical portion
.4070 = Area of radial portion
1.8083 = Total area

Total area (1.8083) ÷ .7854 = 2.302 and by taking the square root of this result we find the diameter of the blank to be 1.517.

In the previous example we had a plain shell with the same thickness of stock in the bottom and sides when the operation was finished; however, there are other problems, such as we have illustrated in Figure 3. In this case we have a decrease in stock from 7/64-in. thickness in the bottom to .055-in. in the side walls.

In this type of part we must use an entirely different formula, as the conditions involved in the problem are different.

In problems of this nature it is common practice to calculate the blank size from the volume of metal in the part. This volume method is just as good, if not better, than any method for determining blank sizes, and the reason that it is not used to a greater extent on other classes of work is the fact that it requires an additional amount of figuring.

The method for figuring volume is as follows:

I. The cylindrical portion.

$$\frac{(\pi \times .865^2}{4} = \frac{\pi \times .755^2}{4} \times (2.625 - .109)$$

$$-\frac{\pi \times .178 \times 2.516}{4} = .3517 \text{ cubic inches.}$$

II. The circular bottom portion.

$$\frac{\pi}{4} \times (.865 - 2 \times .109)^2 \times .109 = .0358 \text{ cubic inches.}$$

III. The quarter circle ring portion.

For this kind of work, the following formula can be set up according to the Guldinus rule:

Let D = the outside diameter of the ring

Let r = the radius of the segment

Thus, r will at the same time signify the height of the ring.

$$\frac{\pi \times r^3}{4} \times \pi \times (D - 2r + 2 \times \frac{.6002}{\sqrt{2}} \times r)$$

This can be simplified to: $2.467r^3$ (D—1.151r).

Using this in our example we have $2.467 \times .109^3 \times (.865 - 1.151 \times .109)$ = .0218 cubic inches.

Adding the three parts together we have:

.3517 cu. in. volume in cylindrical portion
.0358 cu. in. volume in circular bottom portion
.0218 cu. in. volume in quarter circle ring portion
.4093 = Total number of cubic inches in part.

The theoretical blank size will then be:

$$\frac{\pi \times D^2}{4} \times .109 = 4.093 \text{ or } D - 2.183.$$

Theoretically, the diameter of blank will be approximately 2-3/16-in. but on the material layout we have increased the size of this to 2-7/32-in., this allowance being made for the trimming of the shell edge.

In discussing allowances briefly, it should be noted that it is always better to determine the blank sizes on the large side and by using the methods described no trouble should be experienced.

However, it is necessary to allow for all additional operations, such as trimming, beading, sizing, etc.

In the previous examples we have had 90 deg. corners at the bottom, therefore something must be said about the parts with tapered side walls.

As shown in Fig. 4, the center of gravity may be found by the 2/3 B formula, or location C in Fig. 5.

In these illustrations a 60 deg. angle corner is illustrated. This same method will apply to any angle other than 90 deg.

The length of the neutral arc may be found by multiplying the neutral radius by .01745 times the angle.

The final calculation for finding the area of this portion is to multiply the length of the neutral arc by the diameter of the center of gravity times 3.1416.

The method used to obtain the area of a tapered cylinder may be applied to any cylindrical part as shown in Fig. 6.

The circumference of the center of gravity multiplied by the height of one side (taken parallel to it), which in Fig. 6 is 17/32-in.

In straight cylinders the center of gravity comes in the middle between the inside and outside diameters and in tapered cylinders this center of gravity comes at a point midway between the smallest inside diameter and the largest outside diameter.

In Fig. 6 the diameter of the center of gravity is 1-3/32 in., which is the figure between 1-1/4 and 15/16, which are the outside and inside dimensions respectively.

Marketing a New Product

(*Continued from page* 29)

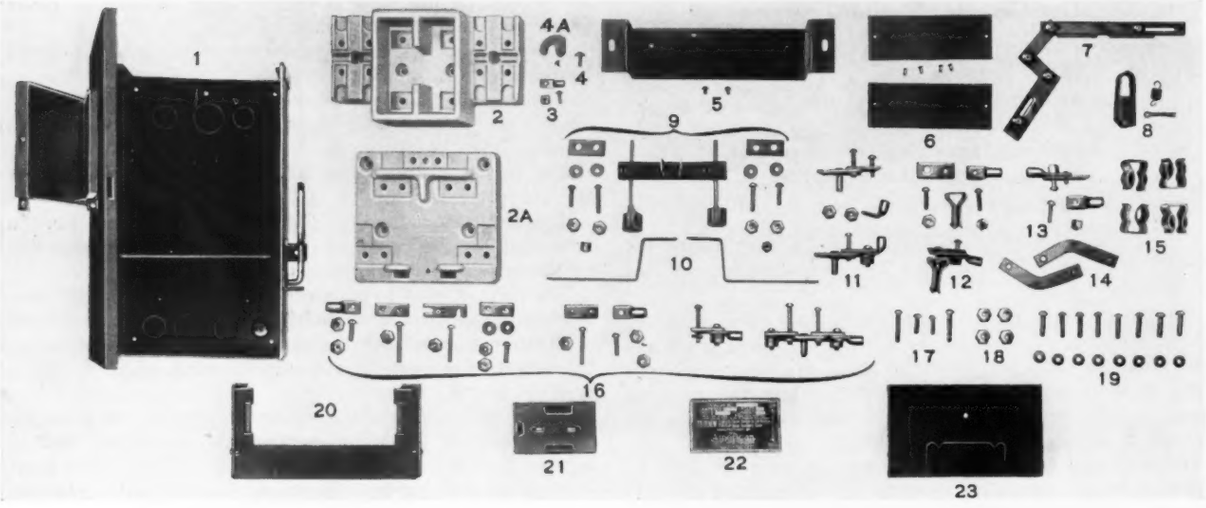
radio infant has grown to such a size that someone in the business is able to order ten thousand head-phones, I guess there must be something to it. Perhaps that's the business for us to get into." After much experimenting a radio set was finally turned out and in a couple of more years the radio end of the Atwater Kent Manufacturing Works had overshadowed the old ignition business.

Many might conclude that Mr. Kent manifested unnecessary fickleness in switching to new products so frequently. However, it should be noted that the changes were seldom of the concern's own volition. It was carried along with the tide. Had an effort been made to resist the tide, the first law of business progress would have been violated and as a consequence the company never would have attained much importance in the manufacturing world. That law, as far as it is applied to manufacturing, is to make a product for which there is a potential demand. Once the market for an article eases off greatly or disappears altogether, it is better to make some new device that is in demand than it is to stick to the obsolescent product.

Mr. Kent never wastes time on a receding market. If the field for a thing is going, he lets it go. He finds that it is much easier to sell the things that are coming in than it is to sell those that are going out. While it is true that he lets his interest in electricity guide him in the development and evolution of his business, he is careful to be interested in electrical articles that will sell.

Safety Switch Components

Sheet and strip steel parts, porcelain, brass, copper and fibre are the principal materials used in the construction of safety switches



ELECTRICAL MANUFACTURING *acknowledges the assistance of the American Electric Switch Company of Minerva, Ohio, in the preparation of the above illustration and the following table of enclosed safety switch parts. From the Biennial Census of Manufactures for* 1925, *published by the Department of Commerce, the annual production of enclosed knife switches, not including industrial motor control switches, was* 2,055,891. *The total valuation placed on this annual output was* $5,925,610

Table Showing Materials Used in Safety Switch Construction

Part No.	Description	Material
1	Cabinet	Steel
	Handle	Steel
	Main door hinges	Steel
	Fuse door hinges	Steel
	Main door lock bar	Steel
	Fuse door lock bars	Steel
	Handle lock brackets	Steel
	Meter trim braces	Steel
2	Cutout base	Porcelain
2A	Switch base	Porcelain
3	Ground lug	Copper
	Bolt and nut	Brass
4	Ground screw	Brass
4A	Door catch	Steel
	Door catch rivet	Steel
5	Cutout block bridge	Steel
	Cutout block bridge screws	Iron, copper-plated
6	Barriers	Fibre
	Barrier rivets	Steel
7	Interlocking mechanism bars	Steel
	Rivets	Steel
	Washers	Iron
	Spring washers	Copper

Part No.	Description	Material
8	Quick break clevis	Steel
	Spring	Steel
	Cotter key	Steel
9	Switch blade assembly—	
	Switch blades	Copper
	Cross bar	Fibre
	Switch blade angles	Steel
	Rivets for mounting angles	Steel
	Rivets for mounting cross bar	Steel
	Handle attachment	Steel
	Handle attachment rivet	Steel
	Hinge jaws	Copper
	Hinge jaw rivets	Steel
	Hinge jaw spring washers	Copper
	Bus bars	Copper
	Mounting screws	Iron, copper-plated
	Mounting screw nuts	Brass
	Potential tap screws	Brass
	Potential tap washers	Brass
	Potential tap nuts	Iron and brass
10	Switch bus bars	Copper

Table Showing Materials Used in Safety Switch Construction—*Continued*

Part No.	Description	Material
11	Test links assembly—	
	Soldering lugs	Copper
	Mounting screws	Iron, copper-plated
	Mounting screws	Brass
	Bus bars	Copper
	Mounting screw nuts	Brass
	Test link handles	Fibre
	Test link handle screws	Brass
	Washers	Brass
	Test links	Copper
12	Break jaw assembly—	
	Break jaws	Copper
	Mounting screws	Iron, copper-plated
	Mounting screw nuts	Brass and iron
	Bus bars	Copper
	Soldering lugs	Copper
13	Neutral bar assembly—	
	Soldering lugs	Copper
	Mounting screws	Iron, copper-plated
	Mounting screw nuts	Brass
	Ground screw	Iron, copper-plated
	Bus bar	Copper
14	Cutout bus bars	Copper
15	Fuse clips	Copper
16	Test links assembly—	
	Soldering lugs	Copper
	Mounting screws	Iron, copper-plated
	Mounting screws	Brass
	Mounting screw nuts	Brass
	Bus bars	Copper
	Test links	Copper
	Test link handles	Fibre
	Test link handle screws	Brass
	Washers	Brass
17	Fuse clip mounting screws	Brass
18	Nuts for attaching cutout to switch bus bar	Brass
19	Mounting screws and washers	Iron, copper-plated
20	Meter trim	Steel
21	Card holder	Steel
22	Nameplate	Brass
	Nameplate rivets	Steel
23	End wall	Steel

Motor Rewinding Costs

(*Continued from page 62*)

stator. One company reports a charge of 5 per cent more than the stator rewinding price.

As already mentioned, this charge can be determined by the use of Table I, and checking the motor frame from the manufacturer's ratings and dimension sheets against the 60 cycle frame and then using that price as the charge. One large firm doing a considerable amount of 25 cycle rewinding charges 20 per cent more than the rewind price for a motor of the same horsepower rating at 60 cycles.

This work can best be done on a time and material basis. One company, however, reports that the cost of rewinding 2300 volt stators will only average 20 to 25 per cent higher than for the stators of 110 to 550 volts, 60 cycles.

The cost of rewinding the stators of this class of motor varies with the make and whether split phase or repulsion induction design. For use in arriving at an approximate estimate of the cost for the rewinding of either stator or rotor, increase the horsepower rating one-half and then use the prices from the curves in Figure 4 for the corresponding size and speed of three phase 60 cycle motor.

In those cases where the stator winding must be insulated thoroughly against acid, alkali, oil and moisture, an approximate estimate of the charge to be added to the price of the stator rewinding job, as shown in Figure 4, can be taken as 40 per cent of the horsepower rating above 10 hp. and equal to the horsepower rating for 10 hp. and below. That is, in case of special insulation for a 20 hp. stator, add to the stator rewinding price 40 per cent of 20 hp., or $8.00. For a 2 hp. motor add $2.00.

The old practice of estimating a rewinding job on the basis of the original price is now fast disappearing as inaccurate and not a fair method of making charges for the repair shop or for the customer. Reference is made to the practice of estimating the cost of rewinding a stator, regardless of condition, as one-half the price of a new motor plus 10 per cent. Only three of the 42 companies reporting price schedules referred to this method of arriving at the rewinding price. When equipped to do rewinding work, and only a small amount is available, it is much safer to render charges on a time and material basis than this practice of cost of new motor plus 10 per cent. Where customers have this basis in mind as the fair charge, it is hoped that the average charges made for rewinding work as presented with this article will be of assistance in correcting this impression in the mind of the customer, and establish the work on the proper price basis. Motors as purchased today are general purpose designs, and when the winding fails, requiring rewinding, it is usually the case that the service required of the motor is unusual in some way. When rewound by an expert winder and insulated to meet the service conditions imposed, the motor resulting in a special purpose design, and so the rewinding price as based on the first cost is not a fair basis of charge.

The average of charges as reported in the price schedules received is given in Table II. These charges compare favorably with the charges shown in Table I and will, of course, depend on the nature of the paint job and the kind of crate that is provided. The charges as given in Tables I and II will serve as the basis of arriving at approximate estimates for extra charges as required for this work. One company reports a base charge of 5 per cent of the stator rewinding price for painting and 5 per cent additional for recrating for shipment. Of the 42 companies reporting repair prices, 6 have a separate schedule of charges for painting and crating and 6 do this work on time and material basis. The remaining 30 companies did not include prices on this work, except in eleven cases, it was stated, that these charges are included in the stator rewinding price, which would seem to indicate that they consider this a very small part of the total stator rewinding price, or they do as cheap a paint job as possible and have a few repair jobs to ship out, all work being for local delivery. If a motor frame is in bad condition as far as paint is concerned, it would be good practice in our judgment to provide a suitable paint covering for the metal, and when this is done it represents work for which there should be rendered a fair charge. It is safe to say that a 50 hp. motor represents enough of an investment to require a good paint job, and that a charge of at least $5.00 for this work is a worth-while service for the customer.

Facts, Figures and Trends

Statistical information of value to electrical manufacturers in working out policies and plans for production and marketing

Orders for Electrical Goods

New orders booked during the fourth quarter of 1928, as reported to the Department of Commerce by 81 manufacturers of electrical goods, were $281,988,159, as compared with $264,466,257 for the third quarter of 1928, and $232,877,670 for the fourth quarter of 1927. Total bookings for 1928 amounted to $1,029,483,218, an increase of 10 per cent over the $926,724,651 of orders booked in the previous year.

Most Radio Sets Sold on Installments

Fifty-three per cent of the radio dealers reporting to the Bureau of Foreign and Domestic Commerce and the National Electrical Manufacturers Association, who were conducting a joint survey, make 50 per cent or more of their sales of equipment on the installment plan. Thirty-three per cent of the total number reporting do from 75 to 100 per cent of their business on that basis.

Electric Pumps in Cuba

The campaign for irrigation in Cuba as a part of the general movement for diversification and expansion of agriculture is giving a great stimulus to the sale of electric and gas motors suitable for use in pumping the water. The Compania Cubana de Electricidad is starting a systematic campaign for the use of electric-driven pumps fed with current from its distribution lines. It would appear that there exists a good field in Cuba for American manufacturers of electric pumps.

Electric Refrigeration in Chile

Growing interest in electrical refrigeration in Chile is shown by the fact that a new building with 18 apartments, which is being constructed in one of the most fashionable sections in Santiago, will be installed throughout with electrical refrigeration. The owner of another apartment building with 25 apartments is considering having every apartment equipped with an electrical refrigerator. With the introduction of electric refrigeration in both of these apartment buildings it is felt that other owners will soon follow suit, which should greatly aid dealers in introducing them into Chilean homes. Up to the present, the household units have been selling very slowly, the largest demand being for commercial purposes.

Exports of Radio Supplies Set Record During 1928

American exports of radio apparatus and equipment in 1928 set a new record, the grand total of shipments being valued at $12,081,410, according to figures just made public by the Electrical Equipment Division of the Department of Commerce.

The full text of the department's statement follows:

The 1928 exports include $768,728 worth of transmitting sets and parts, $4,549,825 of receiving sets, $1,017,560 of tubes, $3,054,310 of receiving set components, and $2,670,987 of receiving set accessories, a grand total for the year of $12,081,410. This is an increase of $2,157,623 over 1925, the highest year in radio exports, when $9,903,787 worth of radio goods were shipped. The percentage of increase is 21.8 per cent.

Increase in Use of Power

The National Industrial Conference Board reports that manufacturing establishments in this country are now using nearly fifty times as much electrical power equipment as they did in 1900, while electric motors installed in 1925 totaled 26,123,573 hp. as compared with 492,936 hp. in 1899. The report further brings out the fact that, whereas in 1899 the horsepower of electric motors amounted to only 4.9 per cent of the total installed power, in 1925 it represented 73 per cent.

Conditions in China

Manchurian conditions are generally prosperous. An unprecedentedly huge influx of immigrants from Shantung and Chihli Provinces have permanently settled upon new farm lands, principally in North Manchuria. This has made for a larger use of tractors for breaking land and in a greater demand for kerosene engines. New railway construction is increasing, telephone and telegraphic communications are improving.

New Hydroelectric Plant for British Columbia

Directors of the British Columbia Power Corporation have announced that a start will be made at once on the first unit of a $7,250,000 power plant at Ruskin, on the Stave River. The first unit will develop 43,000 hp. in one generator.

Market for Electrical Equipment in Java

It is believed that there is a market for electrical equipment of various kinds in Java if the manufacturer is willing to invest enough in that market to send a man to the territory at least once a year. One American firm is doing a steady and profitable business in that country and is getting a good share of the supply of insulators for electric railways and for hydroelectric transmission lines.

Exports to Latin America

A statement, recently issued by the National Foreign Trade Council, on Latin American Trade Development with the United States shows that this country is now supplying 39 per cent of all the world's exports to Latin America, while England, France, and Germany combined supply only 31 per cent.

Electric Appliances in Colombia

Due principally to the fact that electric current rates have taken a decided increase in Bogota, Colombia, and that electric power is limited, the electric light company is not encouraging the further use of electrical appliances at this time. One-quarter horsepower motors of 150 volts are available in Bogota, selling at $40 to $50. The Colombian import duty on these motors is 1 cent per kilogram, gross weight, which includes all packing material.

Refrigeration of Milk in Home Is Studied

Milk keeps best in the household refrigerator when the temperature is maintained at 45 deg., or lower, according to the conclusions reached by Anna M. Pabst, of the Bureau of Home Economics, Department of Agriculture, who has made a study of milk as handled under home conditions.

Market for Corn-Popping Machines in Ontario

It is believed that a large potential market exists in the southwestern peninsula of Ontario for electrically operated corn-popping machines. The availability of cheap electric power throughout that portion of Ontario is favorable to the development of this market. The use of corn-popping machines that require an attendant have helped to stimulate the demand for popcorn, and have paved the way for future development of the market.

Saving by Simplification

Another example of the stimulating effect of simplification is shown by the case of a large lamp manufacturer. This concern reduced its number of general lighting lamps manufactured from 1,260 to 180, and voltages were reduced to 3. Lamp bases were reduced from 179 to 3. As a result of this simplification, prices were reduced 50 per cent in 12 years, and sales increased 74 per cent in four years. Transportation and warehousing expenses were reduced, floor space was more efficient, and employee efficiency increased.

Surpasses even itself!

Peerless Insulation today is a product of evolution. Every property possessed by the first sheet of Peerless has been developed and intensified by scores of improvements during the forty years this remarkable insulation has served industrial America.

The fabric as produced today has a much higher tensile strength. It easily folds with or across the grain without cracking at the fold. Absolute uniformity in thickness has been achieved, as well as a fine, even finish. A new chemical treatment has made it denser and harder, too, without impairing the high dielectric strength which has always characterized Peerless Insulation.

Check up on the service requirements of your products. If any of them need the advantages offered by Peerless, *use* Peerless; for only in this super-paper will you find all these desirable properties present in their relative importance.

NATIONAL VULCANIZED FIBRE CO.
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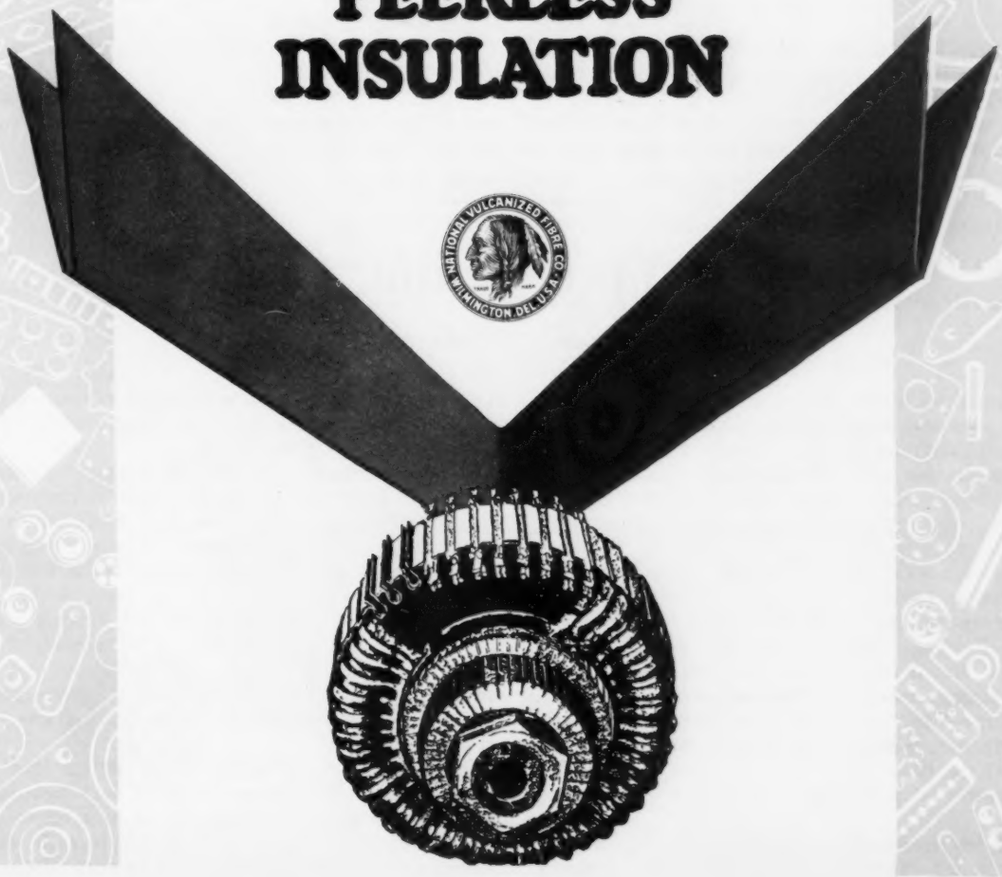

Spain—A Market for Electrical Products

(*Continued from page* 32)

industrial electrical appliances have a ready market, which will expand still more, as time goes on. It seems that the government and the people have set their minds on the industrialization of the country and all efforts are bent in this direction. Electric utilities are helping as much as they possibly can, because it will help them to develop their properties, and increase their production. Right now, their problem is "load building," to flatten their load curve.

I stated before that an extensive water-power development has been started in Spain. As a matter of fact, the development extends also to several other activities, but all related to the electrical industry. It would be impossible to describe here those developments in detail, but I shall enumerate them in order to give an idea of the great opportunities that Spain offers to the American manufacturer of all kinds of electrical supplies. Furthermore, I want to emphasize that these are not mere projects; they are actual developments already started or about to be started. They are:

Hydrolectric Development of the River Ebro Basin (Northeast part of Spain). This is in the construction stage. The name of the enterprise is Federacion Hidrografica del Ebro (Ebro Hydrographic Federation). Its object is to use all the water-power of the River Ebro and its tributaries for irrigation and electricity. All who had water rights are members of the Federation in partnership with the State and the Federation functions as a private corporation. The partnership of the State is only to the end of supplying capital to start and block the possibilities of the formation of a controlling trust.

Hydroelectric Development of the River Douro Basin (Northwest part of Spain). This is in the organization stage. In every detail it is similar to the Ebro development.

A Third Hydroelectric Development on the Guadalquivir River basin will be started in the South as soon as they complete the organization of the one on the River Douro.

A Fourth Hydroelectric Development will be started around the Guadiana River basin as soon as the one on the Guadalquivir River is organized.

Steam Railroad Electrification has been decided and already started. Every mile will be electrified. Power from these developments is the basis of this electrification.

National Power Line. There is a plan to interconnect the old and new hydroelectric developments with steam plants in the coal mine centers to form a super-power transmission line all around Spain. The government has prepared specifications by which private companies can build the section of their lines that could be connected to the super-power line.

The developments mentioned cannot fail to create a tremendous wealth, as immense extensions of land will be irrigated and the establishment of industries encouraged.

In order to give financial assistance to farms and industries, banking concerns assisted by the government have been organized. Finally, in order to promote foreign business, the Banco Exterior de Espana (Foreign Bank of Spain) is being organized.

This report would not be complete without a reference to the two great Spanish expositions to be held during 1929, one in Seville and the other in Barcelona.

The Seville Exposition will be opened in March and is Spanish-American in scope. All the nations of the American continent including, of course, the United States, will be represented. This exposition will be held from March to Dec. 31, 1929. The exposition in Barcelona is international in scope and will contain exhibits from all the nations of the world. It will be open from May to Dec. 31, 1929.

These expositions will attract millions of visitors to Spain, especially Latin-Americans. Here is a splendid opportunity for American manufacturers to present their products not only to the Spanish people, but also to the Latin-Americans and the world at large.

Know Your Selling Costs

(*Continued from page* 38)

partment, Franklin Pottery, Inc., Lansdale, Pa. The plans of this group are still in process of formation.

These officers and directors were elected: President, C. A. Bridges, Moe-Bridges Co.; vice-president, Herman Plaut, L. Plaut & Co.; directors, Joseph Markel, Markel Electric Products, Inc.; L. L. Reading, Franklin Pottery, Inc.; George Klein, Novelty Lighting Corp.; Richard Williamson, R. Williamson & Co.; George Cassidy, Cassidy Co., Inc.

This executive advisory committee was appointed, to meet once a month, the directors meeting four times a year: L. L. Reading, chairman; D. E. Lindsay, Murlin Mfg. Co., and Melvin Spencer, Frink Corp., Inc.

One of the most instructive features of the convention was an illustrated talk by A. L. Powell, manager, engineering department, Edison Lamp Works, Harrison, N. J., who described the new vogue for ornamental lighting effects in the home as providing a valuable potential sales field.

Mr. Powell described modern ornamental lighting as "the jewelry of lighting." "In the home," he said, "no such thing as colored lighting is possible in a general sense, but we can use spots of highlight in color, superimposed upon the general scheme of illumination.

"Is there a market for such ornamental lighting in the home? At Nela Park in Cleveland and at Harrison, N. J., we have exhibits of ornamental lighting, in which the 25,000 or 30,000 people who visit us a year show an outstanding interest. I should say that the potential market might be based on the observation that in some of the homes I know up to eight of these ornamental lighting pieces are now being used. The interest shown already by newspapers, in publishing pictures and articles on this subject, indicate the popular appeal. A motion picture news reel used pictures of some of our pieces without any previous action on our part.

"Ornamental lighting means an additional load for the central station. The housewife leaves such lighting on all the evening because no woman likes a dark room. If only one ornamental lighting piece were sold to each residential consumer, the additional load would be surprisingly large."

A moderately priced slot insulation— G-E No. 1850 insulating paper

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THESE are the characteristics of the new G-E No. 1850 insulating paper: endurance, toughness, flexibility, high dielectric value, high tearing strength, absolute freedom from pinholes; folds without cracking. All these are qualities you want in slot insulating paper, an insulating paper now available at a moderate price.

G-E No. 1850 for slot insulation can be furnished (1) in untreated form, (2) treated with an insulating varnish, or (3) thoroughly impregnated with insulating oil. It is but one of a complete line of insulating papers and fibers manufactured by General Electric.

Become better acquainted with G-E insulating materials; the G-E Merchandise Distributor near you will gladly furnish complete information. Begin by examining a sample of G-E No. 1850 paper which you can obtain, without obligation, by filling out and mailing the coupon below.

800-500

GENERAL ELECTRIC

Section I-483, Merchandise Dept.,
General Electric Company
Bridgeport, Conn.

Gentlemen:

Kindly send me a sample of the new G- E No. 1850 insulating paper

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Electrical Manufacturing News

A department containing news, and descriptions of new materials, parts and devices for the manufacture and repair of electrical products

Low Tension Meter Practice Subject of N.E.L.A. Report

In a serial report of the meter committee, Engineering National Section, National Electric Light Association, the modern trend of low tension metering installation practice is presented, various schemes are discussed and their advantages and disadvantages are pointed out.

The trend of modern installation practice, says the paper, is to provide metal inclosures for all service conductors and metering equipment between the electric company's main and the load side of the meter. This is generally accomplished by inclosing the service wires in metal conduit installed so as to eliminate condulets and pull boxes, and inclosing the main switch, fuses, meter terminals, test facilities and connections in metal boxes or cabinets. The advantages of metal inclosures have become more generally recognized as they minimize accidental damage, make tampering more difficult, serve as a safety measure, and aid in the standardization of meter installations. These features have been determining factors in bringing about a more extended use of metal-inclosed equipment, particularly in the larger companies.

Simplification in installation practice and improvements in methods of connecting small installations, especially those for residences, necessitated some modifications in service-entrance meter designs. In accordance with the practice of some utilities the service fuses must be under seal, inaccessible to the customer but accessible to authorized employees. Other utilties require cabinet construction which will permit the use of main fuses accessible to the customer. It is generally conceded that the most desirable construction does not permit the customer to have access to live parts on the service side of the meter.

The report also discusses service-entrance cabinets, standardization of bases for single-phase meters, polyphase meters, the need for further standardization, small capacity circuit breakers, requirements of service entrance cabinets, and suggested specifications for service entrance meter cabinets under which are discussed classifications, general requirements, sizes, covers, testing facilities, fuses and switches.

Over and Under New York with the Sound Waves

A SPECIALLY shielded microphone in the airplane was used by Leslie Joy, who handled the aerial end of the presentation. Mr. Joy is shown above, addressing his unseen audience from his vantage point far above the Metropolis. In the lower picture is Edmund B. Ruffner, as he appeared handling the "mike," while himself being subjected to an air pressure of 25 pounds per square inch. Both experiments were heard over a national network

RADIO fans recently experienced the unusual sensation of listening to a program broadcast from the air above New York City and from a subway tunnel 65 feet beneath the surface of the East River and 400 feet from the shore. The short wave transmission of the two messages was picked up and rebroadcast from the studio of WEAF

American Welding Society Meets in Pittsburgh

The Pittsburgh district of the American Welding Society held its annual structural steel meeting on Jan. 30 at East Pittsburgh, as guests of the Westinghouse Electric and Manufacturing Company.

The meeting opened with an inspection of the new arc welded factory buildings of the Westinghouse Company at Trafford City, which are now nearing completion. These four structures involve approximately a thousand tons of steel. Welding of steel structures has progressed to the point where a considerable tonnage was erected by the noiseless method in 1928. These structures, in addition to their size, represent further distinct advances in that the variety of construction calls for practically every type of joint common to structural steel practice. Practically all fabrication was done on the ground and the steel erector becomes in reality the fabricator as well.

Following the inspection of the new buildings the society assembled in the Westinghouse Auditorium in East Pittsburgh. E. C. Brown of E. C. Brown Engineers, delivered a paper on the detailing of welded steel buildings. J. F. Minnotte, of Minnotte Bros., who are erecting the Trafford buildings, related the new situations and conditions encountered in such work by erectors. G. F. Emery, chief building inspector of the city of Detroit presented a general paper on structural welding from the standpoint of building departments. About fifty members were present.

Contest Announced for Slogan on Industrial Electric Heat

Seven prizes, totaling $500, will be awarded by the National Electrical Manufacturers Association and the National Electric Light Association for the best slogans to promote the use of electric heat in industry.

Each contestant may submit not more than three slogans, and each slogan must be accompanied by an analysis not exceeding 100 words. Preference will be given to brevity in slogans. The awards will be made on the basis of the best slogan and analysis. First prize will be $250, second $100, third $50, and four of $25 each.

There is scarcely an industry in which electric heat is not applicable. Some of the present industrial uses of electric heat are in smelting, refining, hardening, tempering, and enameling of metals, annealing glass, firing vitreous enamel ware, baking enameled and japanned products, drying painted products, core baking in foundries, commercial baking of bread and cake, and drying fruit.

For the guidance of contestants, the joint

Leadership

maintained over 36 years!

In the infancy of the electrical industry came a need for mica insulation of a size and possessing characteristics that raw mica could not satisfy. In 1892 the Mica Insulator Company filled this need with "Micanite," the original pasted mica insulation. It has long been the standard, throughout the world.

Ever alert to meet the growing needs of the electrical industry, Super-Micanite was developed. It represents a further improvement in pasted mica insulation. Some objections and criticisms were made, and expected, for this is the penalty of leadership.

But again it has been proven that that which is better survives. The use of Super-Micanite is growing by leaps and bounds.

Send for a sample. Subject it to any tests you see fit. We want you to judge for yourself of its outstanding characteristics.

MICA INSULATOR COMPANY

New York: 200 Varick St. Chicago: 542 So. Dearborn St.
Works: Schenectady, N. Y. London, England
Cleveland Pittsburgh Cincinnati Seattle San Francisco Los Angeles Toronto Montreal

PERFECT MICANITE INSULATOR REG. U.S. PAT. OFF.

Electrical INSULATION

PERFECT EMPIRE INSULATOR REG. U.S. PAT. OFF.

MICA INSULATION OILED CLOTH INSULATION

committee of Nema and N. E. L. A. on electric furnace development, sponsor of the slogan contest, states that the following advantages are to be gained by the use of electric heat in industry:

Ease and accuracy of temperature control; uniformity of temperature throughout furnace; ability to maintain predetermined temperature conditions and obtain uniform products day after day; economy through reduction of defective products and reduction of metal losses when melting metal; cleanliness and improved working conditions; safety to people and property; wide applicability wherever heat is required.

Slogans should be broadly descriptive of the possibilities and advantages of electric heat in industry. Contestants should submit each slogan and its accompanying analysis on a separate sheet. The contestant's name and address should appear only on the outside of the envelope, which should be addressed to "Slogan Contest, National Electrical Manufacturers Association, 420 Lexington Ave., New York City." Slogans must be mailed before midnight, May 30, 1929, at which time the contest closes. Results of the competition will not be made public before June 30, 1929.

Americans Plan Participation in Engineering Congress

An international laboratory of world progress and achievements in electrical engineering will be conducted next October by eminent authorities from the United States and other nations at the first World Engineering Congress to be held in Tokio, according to Dr. Elmer A. Sperry, chairman of the American Committee, which is arranging for the attendance and participation of engineers from this country in the meeting.

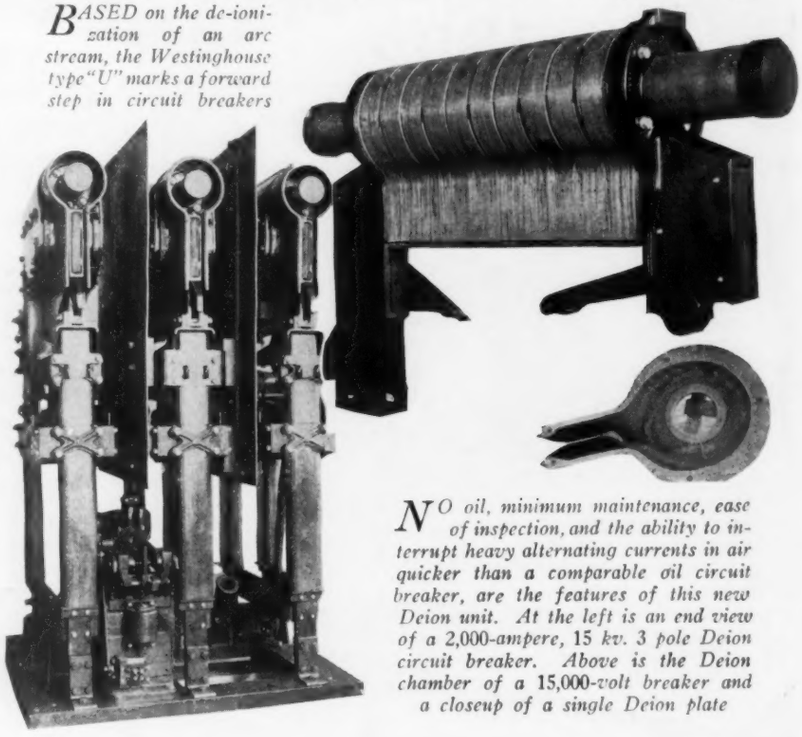
Electrical engineers of prominence from New York, Philadelphia, Pittsburgh, Atlanta, San Francisco and other cities will present papers at the round-table on electrical engineering which will be one of the many sections covering all branches of engineering. Word has been received from Japan, Dr. Sperry said, of some of the subjects to be discussed by electrical engineers from the various countries at the sessions devoted to electrical engineering problems and advances.

The S. S. President Harding, carrying scientists and engineers from the United States, will sail from San Francisco for Japan next Fall and it will be made up of leaders in the engineering profession. D. C. Jackson of Boston, is chairman of the technical program committee which is assigning subjects to be treated in papers by American engineers. The American Institute of Electrical Engineers is acting as sponsor for the program of papers by engineers from this country. According to information received from Japan by Maurice Holland, secretary of the committee, the program has been practically prepared.

Farley Osgood of Newark, N. J., P. M. Downing, vice-president, Pacific Gas & Electric Co., San Francisco, W. E. Mitchell, vice-president, Georgia Power Co., Atlanta, Ga., and E. C. Stone, Duquesne Light Co., Pittsburgh, are collaborating on a paper on "Interconnection and its Effect on Power Development," it was reported. "Remote Operating Supervision and Control of Electric Power Stations and Substations" is the subject of a paper in which these are the collaborators: Chester Lichtenberg, General Electric Co., and F. Zogbaum, New York Edison Co.

A Fundamental Advance in Circuit Breaker Design

BASED on the de-ionization of an arc stream, the Westinghouse type "U" marks a forward step in circuit breakers



NO oil, minimum maintenance, ease of inspection, and the ability to interrupt heavy alternating currents in air quicker than a comparable oil circuit breaker, are the features of this new Deion unit. At the left is an end view of a 2,000-ampere, 15 kv. 3 pole Deion circuit breaker. Above is the Deion chamber of a 15,000-volt breaker and a closeup of a single Deion plate

Industrial Control Merger with Square D Approved

Announcement has been made that the merger of the Industrial Controller Company, Milwaukee, Wis., and the Square D Company, Detroit, has been approved by both companies. The two organizations are important manufacturers of electric switches, panelboards and other electrical control devices. T. J. Kauffman has been selected to head the consolidated companies as president, with F. W. Magin, Carlton M. Higbie and L. W. Mercer as vice-presidents, and W. S. Worcester, secretary and treasurer. The two firms are planning additions to their production quarters.

General Cable Corporation Opens Southern Plant

General Cable Corporation announces the opening on Feb. 1 of the Mobile plant of its Southern States Cable Company Division. Original announcement of this plant was made only a few months ago and the plant was rushed to completion in order to be ready for the large program of electrical construction in the South in 1929.

This is the first wire mill south of Baltimore. The plant will draw and strand copper wire and will also manufacture weatherproof wire. A large part of the plant will be devoted to a complete warehouse stock of all kinds of insulated wires and cables. This stock includes products of the other divisions of General Cable Corporation, including Dudlo Manufacturing Company Division, Rome Wire Company Division, Safety Cable Company Division, and Standard Underground Cable Company Division.

Edison Lamp Sales Heads in Mid-Winter Meeting

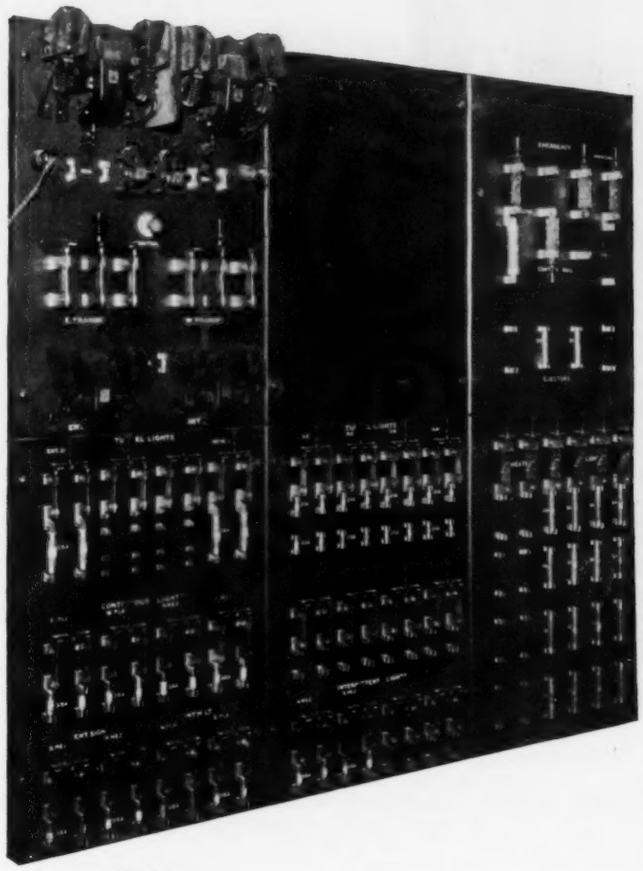
The annual mid-winter conference of the district sales managers of the Edison Lamp Works of General Electric Company was held at the home office of the company at Harrison, N. J., on Feb. 18, 19 and 20.

Following a two-day discussion of sales plans and merchandising activities to be carried out through the remainder of the year, the conferees listened to a series of talks given by B. C. Forbes, editor of Forbes Magazine, T. H. Beck, editorial director of Collier's Weekly, W. W. Freeman, vice-president of the Columbia Gas & Electric Engineering Corp., A. Pryor, Jr., and E. H. Ramsdell, both of Batten, Barton, Durstine & Osborn.

Trumbull-Vanderpoel Purchased by Cutler-Hammer, Inc.

Cutler-Hammer, Inc., Milwaukee, Wis., has acquired the business of the Trumbull-Vanderpoel Electric Manufacturing Company, Bantam, Conn., which will be operated as a subsidiary under its present

In the New Broad Street Subway in Philadelphia You'll Find—



AMBLER EBONIZED ASBESTOS LUMBER

THE ideal material for switch board and insulation uses. Philadelphia's huge subway project includes the best and most modern of materials. Ambler Ebonized Asbestos Lumber was chosen because of its superior dielectric and physical qualities.

At the left is a switchboard in the Transformer Room, Spring Garden Street Station.

Design by Dept. of City Transit.

Manufacturer—Westinghouse Electric & Manufacturing Company.

Contractor—W. V. Pangborne Company, Philadelphia.

Other Ambler Asbestos Products

Ambleroid Cold Moulded Products

Ambler Asbestos Shingles

Ambler Asbestos Corrugated Roofing and Siding

Linabestos

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Leading Electrical Manufacturers Use
AMBLER EBONIZED ASBESTOS LUMBER
Approved by Underwriters' Laboratories

Meets all specifications of Bureau of Engineering, United States Navy, without Restrictions as to thickness.
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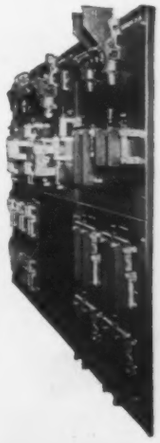


ASBESTOS SHINGLE, SLATE & SHEATHING COMPANY

Main Office: Ambler, Penna. Factories: Ambler and St. Louis, Mo.

BRANCHES

BOSTON CHICAGO PHILADELPHIA NEW YORK CITY WASHINGTON
BUFFALO CLEVELAND PITTSBURGH MINNEAPOLIS WILKES-BARRE

name. This purchase will add a complete line of meter service and safety switches to the present Cutler-Hammer line of motor control, wiring devices and allied electrical items.

Steel and Tubes Names Head for Electrical Division

Steel and Tubes, Inc., Cleveland, Ohio, manufacturer of thin wall conduit, announces that the headquarters of the Electrical Division has been removed to the plant of Steel and Tubes, Inc., of New York, located at Scott and Meserole Sts., Brooklyn, N. Y. Morgan P. Ellis has been appointed vice-president and general manager of this company.

Synthane Corporation Erects New Plant

Synthane Corporation, at Oaks, near Philadelphia, Pa., has completed the erection of its plant, and is now in production of laminated Bakelite products, in sheets, rods, tubes and fabricated parts.

The plant, built solely for the production of laminated Bakelite materials is of modern construction with special equipment of the most up-to-date kind. It is located on the Pennsylvania Railroad System and has adequate facilities for quick delivery.

Synthane Corporation is represented by H. G. Blauvelt, Tribune Bldg., New York; J. B. Rittenhouse, 32-40 Clinton St., Chicago; and C. E. White & Company, Bulkley Bldg., Cleveland.

Brevities

Electric Soldering Iron Company, Inc., announces the removal of its plant from 124 West 18th St., to larger quarters at 135-139 West 17th St., New York City.

Westinghouse Electric Organizes Refrigerator Department

An electric refrigerator department has been organized by the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. Headquarters of the new department have been established at the Mansfield, Ohio, Works, and J. S. Tritle has been appointed general manager in addition to his responsibilities as general manager of the Westinghouse merchandise department. Carl D. Taylor, formerly manager of the industrial division at the Westinghouse Pittsburgh office, has been appointed manager of the refrigeration department by Mr. Tritle.

J. S. Tritle

Geuder, Paeschke & Frey Company, Milwaukee, Wis., has appointed E. H. Wood, 220 Delaware Ave., Buffalo, N. Y., and Charles E. Davis, 888 The Arcade, Cleveland, Ohio, as representatives for the stamping, forming and pressed metal contract department, in the Buffalo and Cleveland territories respectively.

J. Struthers Dunn, Philadelphia, has enlisted the services of Norman McKinney, formerly sales manager for the Signal Engineering Company, to manufacture relays, thermostats and signal equipment under the name of Struthers Dunn, Inc.

Hanson-Van Winkle-Munning Company, Matawan, N. J., announces that C. W. Yerger, Eastern district manager for Cutler-Hammer, Inc., is now associated with Hanson-Van Winkle-Munning as general sales manager. Mr. Yerger had been connected with Cutler-Hammer since 1908. E. N. Boice, who has devoted considerable time to directing Hanson-Van Winkle-Munning sales, besides his duties as secretary, will now devote his full time to the latter position.

Beg Your Pardon

In Electrical Manufacturing for February, 1929, it was erroneously stated that the illustrations which appeared on pages 37, 38 and 39 were contributed by the Starr Porcelain Company, Trenton, N. J. These pictures were used through the courtesy of Porcelain Products, Inc., Findlay, Ohio.

Manufacturers' Catalogs

New Jersey Zinc Company, 160 Front St., New York City. Booklet, zinc and metal alloys. The history of zinc and alloys; brief discussions of the composition and uses of Horse Head, Bertha, Mossy, Nassau, Feathered Slab Zincs; standards and physical properties of zinc in comparison with other metals.

Angle Steel Stool Company, Plainwell, Mich. Catalog C, steel stools and factory equipment.

Timken Roller Bearing Company, Canton, Ohio. This 149-page book shows how universal bearings have become in every kind of equipment and how they have effected radical savings wherever wheels and shafts turn. The book includes technical information on bearing mountings and installations.

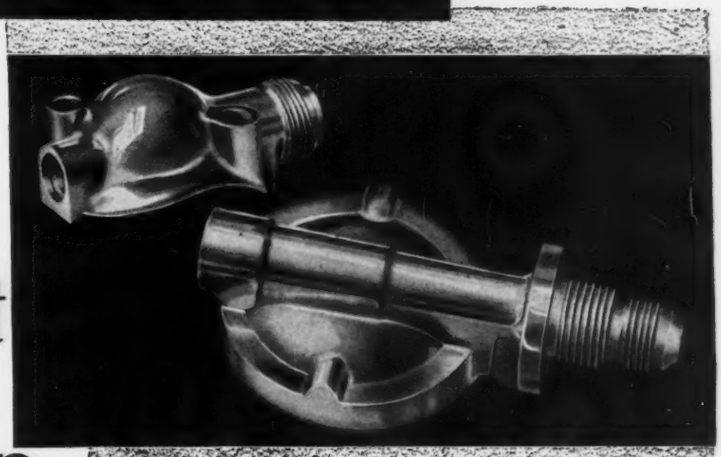
Meadows Introduces New Washer at Three-Day Sales Meeting

THE presentation of the new Meadows Model V Select-A-Speed washer was elaborately staged by a pageant, which dramatically portrayed the elements of capital, labor, advertising, invention, beauty, experimentation and others, all of which were vitally concerned in the development of the company's improved machine. Below is a reproduction of part of the pageant aligned beside the washer. In the inset is Dr. George W. Allison, new sales promotion manager

Five hundred and eighteen Meadows distributors and larger dealers met at a convention conducted by the Meadows Manufacturing Company, Jan. 14-16 at Bloomington, Ill., at which the company's new Model V Select-A-Speed washer was introduced. The new machine provides a washing speed for every type of fabric and changes the transmitted speed without the use of a clutch or the change of a gear.

The introduction of F. E. Hazard as the new director of sales, the announcement of a million dollar appropriation for advertising and sales development and the presentation of L. B. Green, the designer of the new machine, were highlights of the three-day session. Coincidental with the introduction of the washer, the first of a series of Meadows radio broadcasts was transmitted over a special hook-up. An entire day was devoted to a discussion of methods of training salesmen and scheduling future regional training sessions. Diamond buttons were presented to two members of the Meadows organization who had compiled a record of 100 sales.

Answer the insistent voice of competition



Use Stewart Die Casting Process to improve performance, cut costs, hasten production

THE economic advantages to be gained from die casting operations vary with the detail requirements of each job. The net result in one case may be only a reduction in parts cost, in another lighter weight, again faster production or a release of costly manufacturing space to more productive operations.

Completely satisfactory results are as much a result of skillful application of die casting as of the casting process itself.

Stewart engineers and craftsmen have an unusually complete background of experience, and they operate the largest plant in the world devoted exclusively to die castings. Manufacturers are invited to consult the Stewart staff for practical information on the application of the Stewart Die Casting process to their individual needs.

Stewart

THE STEWART
DIE CASTING CORPORATION
4500 Fullerton Avenue, Chicago, Illinois
Detroit • Pittsburgh • Dayton • St. Louis
Newark • Cleveland

EM3-Gray

Personals

John R. Wilkins, for 16 years representative of the Economy Fuse Company, has resigned to become district sales manager for the electrical division of Steel and Tubes, Inc., with offices at 423 Weld Building, Boston, Mass.

Charles A. Dostal, district manager of the Philadelphia, St. Louis and Chicago offices of the Westinghouse Lamp Company for almost 16 years, has resigned to join the American Flyer Manufacturing Company as vice-president in charge of sales. **Fred S. Kinney,** formerly Philadelphia manager, succeeds Mr. Dostal as Middle West manager for Westinghouse Lamp Company.

C. M. Taylor has been appointed sales manager for the Lincoln Electric Company, Cleveland, Ohio. Upon graduating from Western Reserve University in 1916, he joined Lincoln and shortly thereafter was selected foreman of the test and assembly departments. In 1923 he was promoted to factory manager and two years later was elected vice-president. He remained as factory manager until his recent promotion.

H. H. Wood, formerly chief engineer for the Laclede Steel Company of St. Louis, has joined the industrial department of the Timken Roller Bearings Company, Canton, Ohio. He will specialize in the application of Timken bearings to steel mill equipment of various sorts.

A. R. Pierson has been appointed district manager of the new branch office of the Maloney Electric Company, St. Louis, which has been opened at 101 Marietta St., Atlanta, Ga.

William J. McIlvane has been named general sales manager of the Metropolitan Device Corporation, 1250 Atlantic Ave., Brooklyn, N. Y., manufacturer of protective devices, distribution equipment and radiators. He was formerly associated with the Copperweld Steel Company, Glassport, Pa., as district manager.

Obituary

Thomas Duncan, president of the Duncan Electric Manufacturing Co., Lafayette, Ind., died in Los Angeles, Jan. 21. He was born in Scotland in 1865 and came to America in 1883. He was connected with the Fort Wayne Electric Co. and the Siemens & Halske Electric Co., before he founded the Duncan Company in 1901.

Raphael E. Gallagher, president of the New York Insulated Wire Company, died in New York, Feb. 11. In 1884 he organized the company of which he was head and which is now a member of the wire and cable section of the National Electrical Manufacturers Association. Mr. Gallagher, who was 78, held the position of secretary of his company from its founding until 1927.

F. L. Mueller, vice-president of the Advance Spring & Wire Company, Chicago, was killed in automobile accident on Feb. 1. He was 29 years of age, a son of F. C. Mueller, president of the Advance Company.

Coming Conventions

American Institute of Electrical Engineers.—Regional meeting at Cincinnati, March 20-22; Dallas, Tex., May 7-9; Swampscott, Mass., June 24-29.

American Society of Mechanical Engineers. — Regional meeting at Knoxville, Tenn., March 22-23; Regional meeting at Salt Lake City, Utah, July 1-4.

American Society for Testing Materials.—Annual meeting at the Chalfonte-Haddon Hall, Atlantic City, N. J., June 24-28.

American Welding Society.—Annual meeting at the Engineers Society Building, 29 W. 39th St., New York City, April 24-26.

Institute of Radio Engineers.—Annual meeting at the Mayflower Hotel, Washington, D. C., May 13-15.

National Electric Light Association. —Annual convention and exhibition at the Municipal Auditorium, Atlantic City, N. J., June 3-7.

National Electrical Manufacturers Association. — Spring meeting at Hot Springs, Va., week of May 20.

National Electrical Wholesalers Association.—Semi-annual convention at the Homestead, Hot Springs, Va., May 27-31.

Information Wanted

Information Wanted

We have been asked for the names and addresses of manufacturers of the articles listed herewith.

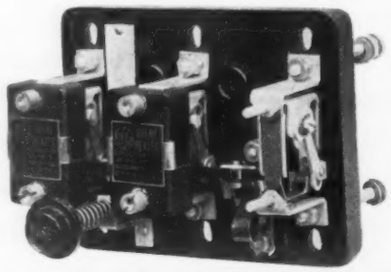
Replies from our readers to any of these inquiries will be greatly appreciated by the Information Bureau of Electrical Manufacturing, 461 Eighth Avenue, New York City.

"Burrows" Therapeutic Lamp.
"L. R. Co." Receptacles.
"Williams" Commutator Dressing.
"Splendida" Electric Iron.
"Graustark" Line of Lighting Fixtures.
"Sal Co. 176" Lamps.
"Electron" Heating Pad.
"Lilly Wilson" Vacuum Cleaner.
"Perkins" Siren.
"Flint" Waffle Iron.
"Packard" Vacuum Cleaner.
"Blaisdell" Automatic Electric Cigar Lighter.
"Columbus-Universal" Electric Vacuum Cleaner and Floor Polisher.
Manufacturers of Electric Incinerators.
"Defiance" Cigarette Lighter.
Manufacturers of Electric-driven lampshade lacing machines.
"Vesodore" Cigar Lighter.

New Goods for Your Inspection

Overload Relays

General Electric Co., Schenectady, N. Y., has placed on the market double and triple-pole temperature overload relays, the principal advantages of which lie in the construction allowing the user to remove and insert heating elements when



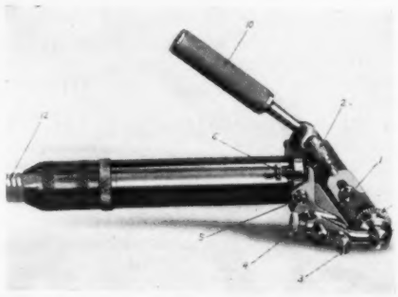
necessary. These relays permit the use of a third relay unit on the same base when it is desired to protect three legs of a circuit. TC-121 relays are designed for protection of two legs of a circuit, while TC-131 provides an element for the protection of the third leg. Both relays have a current-carrying capacity of 30 to 150 amperes, and are available for either front or back connecting.

Radio Grille Cloth

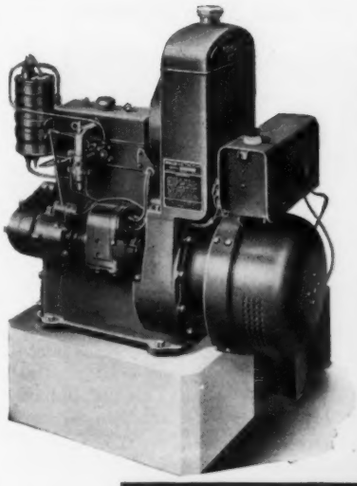
Tindall Fabrics Corp., 200 Madison Ave., New York, has brought out several patterns in radio grille cloth and announces that its mill at Pawtucket, R. I., is in a position to work out special constructions, patterns and colors according to specifications.

Mica Undercutter

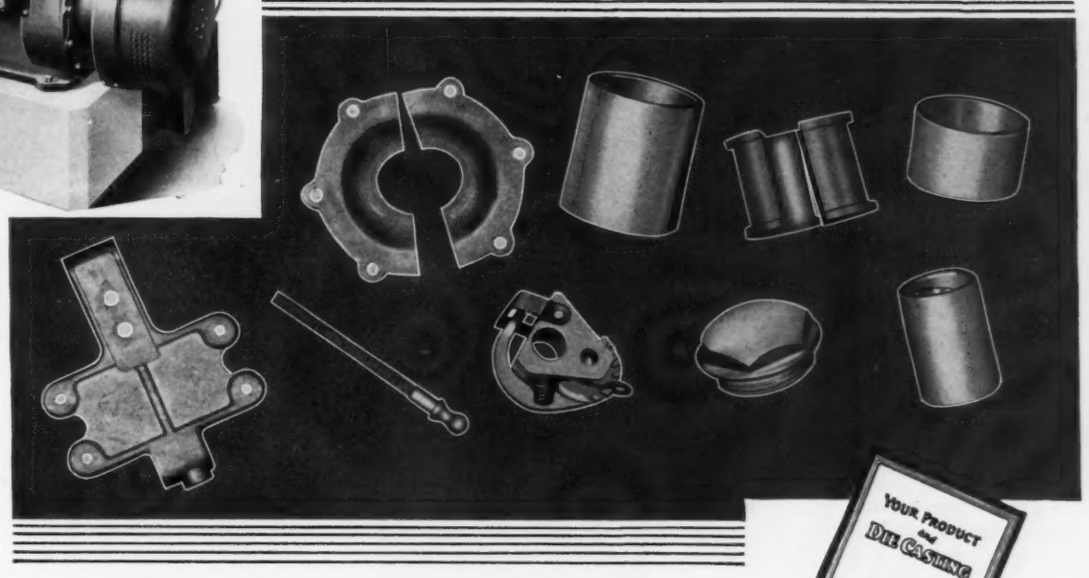
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill., has placed on the market a motor-driven mica undercutter that operates in a space 3½ in. wide, so that it is unnecessary to dismantle brush rigging. It is provided with a set screw for locking the depth gage, which is raised and lowered by means of a micrometer adjusting screw. A micrometer screw for



adjusting and setting the roller guide the proper distance from the cutter is provided. The distance between the cutter and the roller guide is less than the width of the average small copper bar, thus permitting the guide to be used on the next slot and requiring but one slot to be cut by hand. The cutter is driven by a flexible shaft direct connected to motor.



Reducing costs for... KOHLER *of* KOHLER



This non-technical booklet on the die-casting process will help you decide whether or not parts of your product can be die-cast to advantage.

THE Kohler Automatic Light Plant provides an outstanding example of the manufacturing economies which can be effected through the proper application of die castings.

In this particular assembly, ten Milwaukee Die Castings made of four different alloys are used. Undoubtedly some of these parts could be made of other materials and by other methods, but Kohler engineers were convinced that correctly designed die castings would serve the purpose more effectively at a much lower cost.

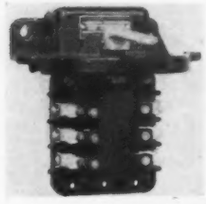
The engineers were right! On four parts, alone, the use of die castings has eliminated nine machining operations, three patterns and five jigs, reducing the cost approximately 50%.

Perhaps a survey by Milwaukee Die Casting Technicians would uncover the possibility of similar savings in the manufacture of your product. Why not have one made without cost or obligation?

MILWAUKEE DIE CASTING COMPANY
289 FOURTH STREET MILWAUKEE, WIS.

MILWAUKEE
DIE CASTINGS AND BEARINGS

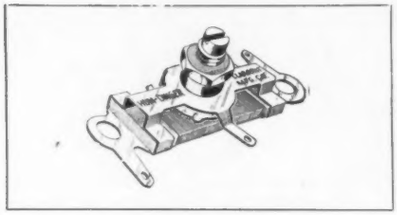
Oil Immersed Switch



General Electric Co., Schenectady, N. Y., announces a small, oil-immersed switch for throwing small alternating or direct current motors across the line. It consists of a one-piece cast iron cover, including the switch mechanism and a small cast iron tank for the oil. The molded composition switch base carries the stationary contact stud parts and the moving contact assembly is mounted on another one-piece molded part. The contacts are of the silver to silver, double break type. The use of these contacts and the molded arm eliminates shunts or drum type contacts. The cover is provided with two mounting holes. Provision is made for conduit connection by means of an incoming conduit box cast into the cover.

Center Tap Resistance

Clarostat Mfg. Co., Inc., 285 N. Sixth St., Brooklyn, N. Y., has placed on the market the Hum-Dinger adjustable center tap resistance. This device is designed to be as compact and simple as possible. A positive contact slides over the center portion of the winding, actuated by a slotted shaft which can be turned with an ordinary



screwdriver. The device can be mounted on a panel or subpanel by means of a single hole or on the baseboard by screws slipped through holes in the end lugs. Connections are made to three soldering tabs. The standard resistance value for the usual A. C. tube circuits is 30 ohms, but other values from 6 to 500 ohms are available.

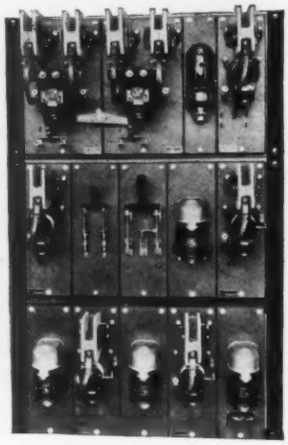
Edgerest Resistance Unit

Industrial Controller Co., Milwaukee, Wis., has brought out the Edgerest resistance unit. It consists of a Nichrome ribbon shaped into the form of a zigzag. The

end of each convolution is held in a recess provided in the porcelain supporting section. The porcelain unit is sectional and slips into scored channels which provide a substantial construction and at the same time is light in weight. Unit construction permits any number of units to be mounted one above the other by means of a slip-on clamp which snugly fits a rod. This rod also accommodates spacers between units. The terminal clamps are so designed that they may be attached to the high resistance ribbon at any point.

Time-Current Control

Electric Controller & Mfg. Co., 2700 East 79th St., Cleveland, announces the time-current controller using a time-current acceleration relay designed to have all the advantages of the existing systems of acceleration. On light loads, such as screw downs, mill tables, and other drives



where fast operation means increased production, time-current control is designed to give maximum output. On heavy loads a longer time up to two seconds per step is obtainable automatically and without any change in adjustment. On normal loads, forced acceleration gradually increases the torque until the motor starts.

O-Z Hand Tachometer

O. Zernickow Co., 15 Park Row, New York, is introducing to the trade the O-Z hand tachometer, whose small size, ruggedness and accuracy are said to supply the needs for reliable, durable and handy speed measuring instrument. It indicates, without timing or calculating, the r.p.m., right or left, of revolving objects (shafts, spindles, etc.); the surface or peripheral speeds in r.p.m., right or left, of traveling objects (flywheels, pulleys, belts, drums, lathes, planers); speed variations occurring during a fraction of a revolution; and belt slipping.

Slot Insulating Paper

General Electric Co., Merchandise Dept., Bridgeport, Conn., has placed on the market a smooth, tough, flexible fiber paper of high mechanical and dielectric strength and designed particularly for use as slot insulation. This material also has such qualities as resistance to folding, high tearing strength and high tensile strength. This paper, known as No. 1850, is also furnished as follows: treated with an insulating varnish and designated No. 1851, treated with an insulating oil and known as No. 1852.

Clarostat Strip Resistors

Clarostat Mfg. Co., Inc., 285 N. Sixth St., Brooklyn, N. Y., has brought out a line of Clarostat strip resistors. The fiber support in these resistors is threaded so that the turns are held firmly in place, preventing short circuited turns and altered resistance. The fiber has rounded sides for less strain on the wire and for neatness. The ends are firmly clamped for positive contact and mechanical strength and have mounting holes as well as soldering tabs. The resistance value is stamped on one end of the resistor. They are available in any value from 1 to 3000 ohms and can be furnished in an adjustable model if preferred.

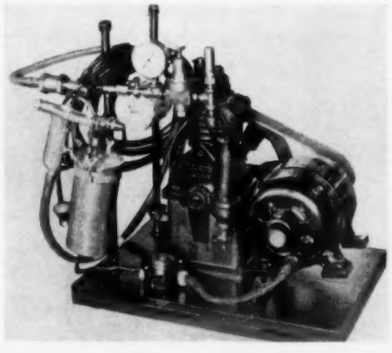
Fuse Clips

H. B. Sherman Mfg. Co., Battle Creek, Mich., announces a line of fuse clips. Ferrule types are made of special phos-

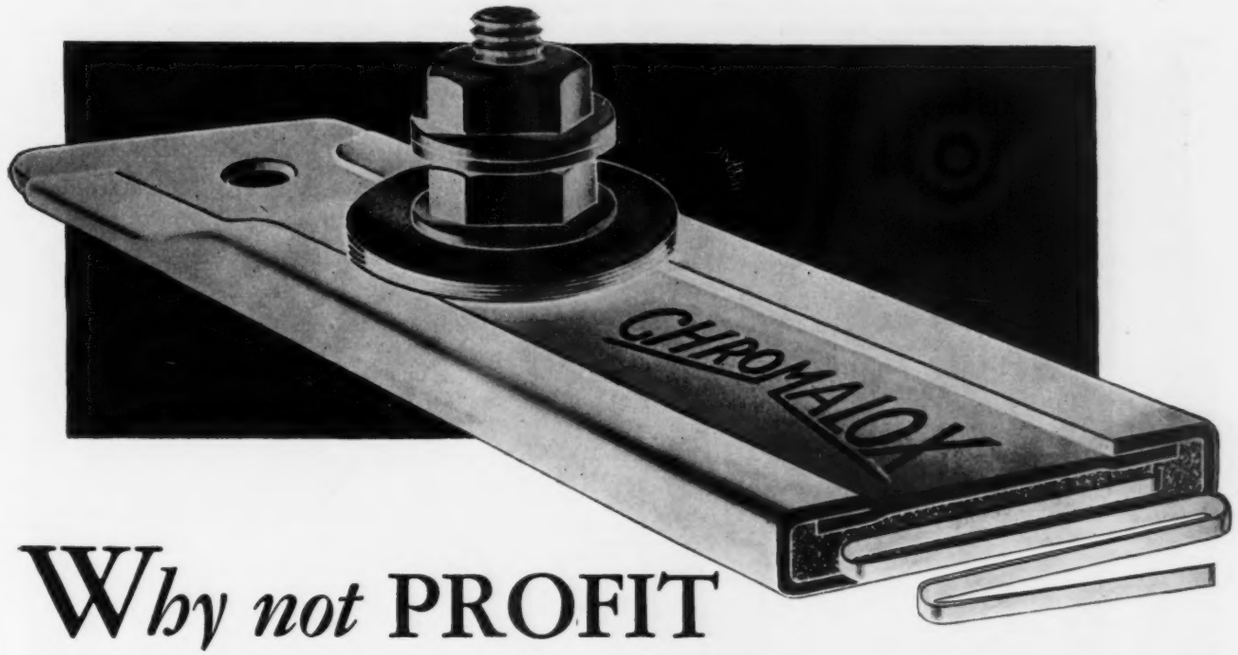
phore bronze, said by the manufacturer to be the only non-ferrous metal which will retain spring temper while under tension for a long time. Knife-blade types are heavy, special temper spring copper, and especially designed to secure strong spring tension with snug contact. These clips are made for 250 and 600 volt service. Special sizes are made to order if quantity is sufficient.

Air Brush Unit

Willard C. Beach Air Brush Co., Second and Warren Sts., Harrison, N. J., is marketing Model No. Z50 motor-driven air brush unit for spraying insulating varnishes and compounds on field coils and armature windings. A type BS cup gun is used with the outfit. The low pressure



internal mixture nozzle is designed to reduce mist and fog and waste of material. The pressure feed material cup will force heavy materials through the nozzle at low spraying pressures so that it is not necessary to add an excessive thinner or solvent. The gun can be used with 2, 5, 10 or 20 gal. pressure tanks instead of the feed cup shown in the illustration. The motor operates on the convenience outlet.



Why *not* PROFIT

by what sixty manufacturers would tell you about heating units?

FROM your standpoint, these far-sighted manufacturers know what they are talking about. They have been through the experimental stages, made tests. And then found it more economical all around, to adopt Chromalox units—for good.

Built to FIT Your Products

Certainly it's sound business to profit by what they've learned about Chromalox units: How they are built to last; to fit the product itself; to give the right heat. In short, to keep the product operating as it should, for a long time. The patented Chromalox construction of a resistor hydraulically embedded into a heat-conducting, insulating material—makes all this possible.

Lower Assembly Costs

Customers, call us in to help with the final design of their products, to show them the right way to build in the heating units. As a result, assembly costs are lowered. Chromalox units are designed to FIT the product.

Chromalox-equipped Products STAY SOLD

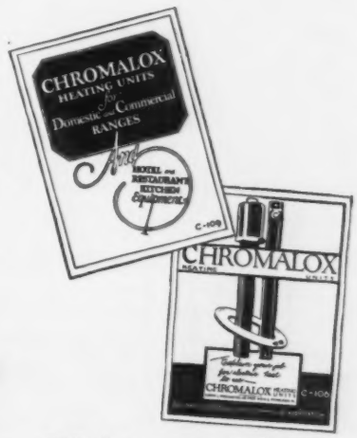
Most of the guess work about your product doing a real job can be easily eliminated by using Chromalox units. Automatically, kicks and come-backs are side-tracked when you use these trouble-free units—another important point those manufacturers will tell you about.

But What About Your Products?

Whether you are working on a new product or improving an old one, we can be of valuable help to you with experience gained from years of working with leading companies making all kinds of electrically heated equipment. When you write for the Chromalox bulletins, tell us about the appliances or heating devices you want properly heated. There's no obligation!

Boiled down to a few words, this is what they'd say . . . .

"Frankly, it is simply a waste of time and money to try to make heating units when it's so easy to buy Chromalox units — really made to fit your products."



Write for your copy of these 8-page bulletins showing dozens of sizes and ratings of the largest complete line of heating units.

Chromalox

ELECTRIC HEATING UNITS

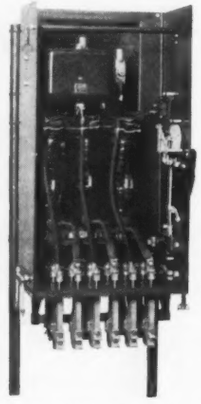
Manufactured Exclusively by . . . Edwin L. Wiegand Company, 420 First Avenue, Pittsburgh, Penna.

Sheet Metal to Wood Nails

Parker-Kalon Corp., 190 Varick St., New York, announces the Screwnail, a nail for fastening sheet metal to wood. This device has a hardened spiral thread and a needle pointed pilot which enables it to be driven through heavy sheet metal without bending. In many instances, it is said to eliminate the necessity of drilling holes in the metal. The manufacturer states that laboratory tests have shown that this nail has over four times the holding power of ordinary nails.

Manual Starting Compensator

General Electric Co., Schenectady, N. Y., announces Type CR-1034-K-33, manual starting compensator with high interrupting capacity. It is especially applicable to the control of high-speed, squirrel-cage motors, including all two and most four-pole motors, particularly those driving loads of relatively high inertia, taking high inrush currents and, therefore, requiring considerable time to get up to speed. Among the advantageous features claimed for the compensator by the manufacturer are: A switch design providing wide break



and high interrupting capacity; time-delay, under-voltage release preventing shutdown on brief power disturbances and assuring that in case of short circuit, the line protective devices will open first; contact tips of standard contactor construction and action, reducing maintenance cost to a minimum; and cabinet construction of case for wall mounting with ample room for ready connections and access to all parts.

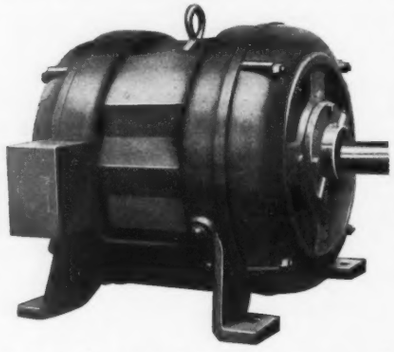
Herringbone Speed Reducers

Palmer-Bee Co., Detroit, Mich., has placed on the market a line of herringbone speed reducers equipped with anti-friction bearings throughout. Ball bearings are used on the high speed shafts and roller bearings on the slow speed shafts. The gears are of the continuous tooth herringbone type with silent Kysor tooth form, producing more rolling and less sliding action than was obtainable heretofore. The slow speed gears in the double and triple series are divided in the center, permitting a more symmetrical arrangement of the gearing and a uniform load on the bearing. Alignment of the reducer is facilitated by means of a three point mounting. No outboard bearings are required for overhung loads up to the maximum rated

capacity of the reducer. The efficiency of the single series reducers is approximately 99 per cent, and of the double series about 97 per cent.

Fan-Cooled, Enclosed Motors

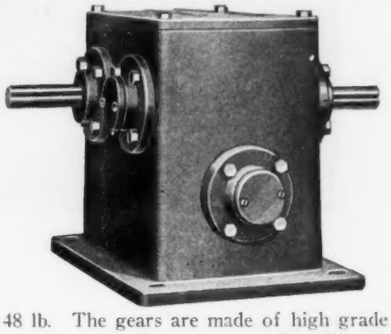
Westinghouse Electric & Mfg. Co., East Pittsburgh, has placed on the market a fan-cooled, totally enclosed motor of the squirrel cage type. This motor is designed for use on drives where the service conditions are too severe to permit the use of a standard open motor, such as foundries, cement mills, coke plants, flour mills, and machine shops. These motors are of approximately the same size as the standard open motors of the same rating. In construction, these motors are identical with the standard open motors. The stators differ only in that the ends of



the windings are inclosed in sheet metal protective housings. The rotors are the same except for the addition of a machined steel collar mounted on either end of the shaft. These collars serve as supports for the external cooling fans. The fans draw outside air in through the brackets at either end and, after directing it over the entire outside surface of the protective housing, discharge it through the middle section. This construction makes possible the use of short direct air passages. The clean air sealed in the interior of the motor is kept in circulation by blowers on the ends of the rotor. These motors are equipped with ball bearings. This construction is essential, due to the minimum amount of end-play allowable. These motors use the same control as any standard squirrel cage motor and may be started either at reduced voltage with an auto-starter or across full-line voltage.

Speed Reducing Unit

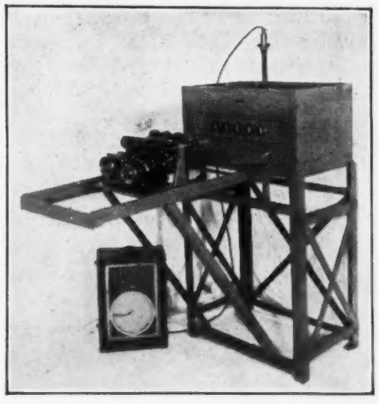
Winfield H. Smith, Inc., Springville, N. Y., announces WHS, Model No. 4D reducing gear which is available in ratios of reduction from 100-1 to 2500-1. The unit uses a double worm gear drive having the driving and driven shafts parallel. Ball thrust bearings are used at each end of the two worm shafts. The unit is mounted on a base 7 by 8⅜ in. and weighs



48 lb. The gears are made of high grade gear bronze. The worms are of steel, hardened and polished. Because of the large ratio of reduction, the actual horsepower ratio of these units is very small. In applying this unit, the manufacturer must know the torque in inch-pounds or the thrust load that will come on the gear teeth before the unit can be definitely recommended for an application.

Enameling Oven

Frederick M. Conran, 177 New York Ave., Newark, N. J., is marketing an electric oven for enameling. The inside dimensions of the oven are 13½ in. wide, 4½ in. high and 9 in. deep. The heating element is heavy nickel-chromium wire, spiralled and placed in grooves in the furnace lining. It uses a maximum of 3 kw. on 220 volts. A recording pyrometer is supplied with the oven and temperatures up to 2000 deg. Fahr. may be obtained. The temperature may be maintained at any predetermined value by means of a rheostat (not shown in the illustration). At the front of the oven is shown the enameling



mechanism. Arbors of heat resisting alloy are placed in the chucks and the pieces to be enameled are placed on the arbors. The chucks are rotated at 4 r.p.m. through a speed reducer from a ⅛-hp. motor. While one set of parts is baking another set can be made ready on a carrier at the back of the furnace and placed inside as soon as the enamel is thoroughly fused.

Balanced Values

Of the major qualities which, summed up, represent the measurable value of a die casting, the invisible one of SERVICE ranks foremost in the minds of most buyers. The value of NEWTON SERVICE becomes manifest on short acquaintance. It balances the quality value which has been responsible for the still growing preference for this Company's product.

The NEWTON DIE CASTING Corp'n.

146 Munson St. NEWTON NEW HAVEN New Haven, Conn.

Index of Raw Materials, Parts, Electrical Equipment

For all electrical products including electrically operated machines and appliances

Trade Names—Manufacturers' Names—Local Addresses

The names of all manufacturers are grouped alphabetically under the heading for the product they manufacture. Trade names also appear in alphabetical position under the subject identifying the product. Thus "Linolac" insulating varnish will be found in alphabetical position under the heading "Paint, Varnish, Lacquer."

Note: The Classified Index of **ELECTRICAL MANUFACTURING** is limited to those subjects of interest to the specific field which it covers, for obvious reasons. A complete Classified Index of all electrical commodities bought, sold, or used by Electrical Supply Jobbers, Contractors, Dealers, Central Stations and other electrical industry outlets appears regularly in each issue of **ELECTRICAL RECORD** as heretofore. This Classified Index has been an exclusive **ELECTRICAL RECORD** feature for over thirty-six years.

ALLOYS, LIGHT METAL
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bohnalite. See Bohn Aluminum & Brass Corp.

ALUMINUM
(Also Aluminum Bronze Powder.)
Albron, Alcoa, Alumac. See Aluminum Co. of America.
Aluminum Co. of America, 2444 Oliver Bldg., Pittsburgh.

AMMETERS. See Instruments.

ARMATURE
Balancers. See Balancers, Armature.
Banding Machines. See Banding Machines, Armature
Bearings. See Bearings.
Buggies. See Lifts, Armature.
Coil Presses. See Presses, Armature Coil.
Coils. See Coils, Finished.
Core Punchings. See Discs, Armature.
Cranes. See Lifts, Armature.
Discs. See Discs, Armature.
Driers. See Ovens.
Growlers. See Testers, Coil.
Hoists. See Lifts, Armature.
Impregnators, Vacuum. See Ovens, Industrial.
Jacks. See Lifts, Armature.
Laminations. See Discs, Armature.
Lathes. See Lathes.
Lifts. See Lifts, Armature.
Mew. See Coils, Finished.
Notching Machines. See Notching Machines, Armature.
Pegs. See Pegs, Armature.
Pinion Pullers. See Pullers, Armature Shaft.
Repaired. See Repairing and Second-Hand.
Shaft Pullers. See Pullers, Armature Shaft.
Shaft Straighteners. See Straighteners, Armature Shaft.
Stands. See Stands, Armature.
Test Benches. See Test Benches, Armature.
Testers. See Testers, Coil; also Test Benches, Armature.
Torpedo Cord. See Twine, Armature Winding.
Trouble Shooters. See Testers, Coil; also Test Benches, Armature.
Trucks. See Lifts, Armature.
Wedges. See Pegs, Armature.
Winding Machines. See Winding Machines, Armature & Field Coil.
Winding Twine. See Twine, Armature.

ARMATURE & COIL SPRAY GUNS. See Spraying Outfits.

ARMORING MACHINES. See Wire Manufacturing Machines.

ARMS, FLEXIBLE. See Tubing Flexible Metallic.

ASBESTOS Shades. See Shades, Fabric.
Paper & Sheet. See Asbestos.
Slabs. See Asbestos Slabs.
Tape. See Tape, Asbestos.
Wire. See Wire, Insulated.
Yarn and Thread. See Yarn and Thread.

ASBESTOS
Sheet, Paper, Mill Board, Lumber.
Asbestos, Shingle, Slate & Sheathing Co., Ambler, Pa
Easco. See Eastern Asbestos Co.
Eastern Asbestos Co., Providence, R. I.
Ferodo & Asbestos, Inc., New Brunswick, N. J.
Johns-Manville Corp., New York, N. Y.

ASBESTOS SLABS
Slabs & Barriers for Switchboard.
Asbestos-Ebony. See Johns-Manville, Inc.
Deceleco, Inc., Wayne, Mich.
Johns-Manville Corp., New York, N. Y.
Transite. See Johns-Manville, Inc.
Zellite. See Deceleco, Inc.

BAGS, Vacuum Cleaner
Merrimack Mfg. Co., Boston, Mass.

BALANCERS, Armature
(Dynamic Balancing Machines—Balancing Ways).
Anderson Bros. Mfg. Co., Rockford, Ill. (Ways).
Armature Coil Equip. Co., 2415 Forestdale Ave., Cleveland, O. (Machine).
Bowsher Co., N. P., South Bend, Ind.
Oleen Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa. (Machines).
Sundstrand Machine Tool Co., Rockford, Ill.
Twentieth Century. See Sundstrand Machine Tool Co.
Vibration Specialty Co., 1534 Winter, Philadelphia, Pa. (Machines).

BALL BEARINGS. See Bearings, Ball and Roller.

BANDING MACHINES, Armature
Columbia Machine Wks. & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Ridlon Company, Frank, Boston, Mass.

BARRIERS, Switchboard. See Slate; also Soapstone; also Asbestos.

BARS, BUS. See Brass, Bronze & Copper; also Aluminum.

BARS, Commutator
American Brass Co., 25 Broadway, New York, N. Y.
Anaconda. See American Brass Co.
Buckeye Tempered Copper & Brass Co., Mansfield, O.
Cameron Electric Mfg. Co., Ansonia, Conn.
Commutator Co., 121 N. Front, Minneapolis, Minn.
Eureka Copper Products Corp., North East, Pa.
Homer Commutator Co., 4743 Hough Ave., N. E., Cleveland.
Rome Brass & Copper Co., Rome, N. Y.

BASES, Radio Tube. See Radio Molded Parts.

BASES, Reading Lamp
Metal, Pottery, Wood & Glass.
American Ring Co., Waterbury, Conn.
Aladdin Mfg. Co., Sales Div. No. 802, Muncie, Ind.

Armor Bronze Co., Garwood, N. J.
Camden Art Tile & Pottery Co., Camden, Ark.
Colonial. See Old Colony Iron Wks.
Estes & Sons, E. B., 5844 Grand Central Terminal, New
Fulper Pottery Co., Flemington, N. J.
Globe Metal Spinning Co., 178 Centre, New York, N. Y.
Hemill Products, Inc., 103 Mott, New York, N. Y.
Insulation Mfg. Co., New York Ave. and Herkimer St., Brooklyn, N. Y.
Marblcart. See Insulation Mfg. Co.
Natural. See Insulation Mfg. Co.
Old Colony Iron Wks., Bridgeport, Conn.
Rodale Mfg. Co., 300 Hudson, New York, N. Y.
Sneath Glass Co., Hartford City, Ind.
Van Briggle Tile & Pottery Co., Colorado Springs, Colo.
Weller, S. A., Zanesville, O. (Pottery.)
Yokel Corp., 219 Homestead Ave., Hartford, Conn.
Zane Pottery Co., South Zanesville, O.

BATTERY CHEMICALS. See Chemicals, Battery.
BATTERY CUT OUTS. See Switches, Battery.
BATTERY GAGES. See Instruments, Pocket.
BATTERY JARS. See Jars, Battery, Glass; also Rubber; also Molded Insulation.
BATTERY OXIDES. See Chemicals, Battery.
BATTERY SALTS. See Chemicals, Battery.
BEAD CHAIN. See Chain, Socket.
BEADS, Chandelier. See Crystals, Chandelier.

BEADS, Insulating
American Lava Corp., 1425 William, Chattanooga, Tenn.
Dunco. See Struthers Dunn, Inc.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.

BEARINGS
Ball & Roller. See Bearings, Ball & Roller.
Graphite. See Bearings, Oil-less.
Oil-less. See Bearings, Oil-less.
Sleeve. See Bearings & Bushings.

BEARINGS, Ball and Roller
Ahlberg Bearing Co., 317 E. 29th, Chicago, Ill.
Bantam Ball Bearing Co., South Bend, Ind.
Commercial. See Schatz Mfg. Co.
C J B. See Ahlberg Bearing Co.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearing Co., Poughkeepsie, N. Y.
Gurney. See Marlin-Rockwell Corp.
Hyatt Roller Bearing Co., Newark, N. J.
Hoffman. See Norma-Hoffman Bearings Corp.
McGill Metal Co., Valparaiso, Ind.
Marlin-Rockwell Corp., Jamestown, N. Y.
Mathews Mfg. Co., 194 Gold, Worcester, Mass.
New Departure Mfg. Co., Bristol, Conn.
Nice Ball Bearing Co. (Nicetown), Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Whitehead Rd., Trenton,
Schatz Mfg. Co., Poughkeepsie, N. Y.
Schubert. See McGill Metal Co.
Standard Steel & Bearings, Inc., Plainville, Conn.
Strom Bearings Co., 4587 Palmer, Chicago, Ill.
S. K. F. Industries, 40 E. 34th, New York, N. Y.
Timken Roller Bearing Co., Canton, O.
Torrington Co., Torrington, Conn.

BEARINGS, Oil-Less
Argute Oilless Bearings Co., 149 Berkeley, Philadelphia, Pa.
B. M. C. See Burlington Metal Corp.
Bogert & Hopper, Inc., 225 Varick, New York, N. Y.
Bound Brook Oil-less Bearing Co., Bound Brook, N. J.
Burlington Metal Corp., Burlington, Wis.
Cleveland Graphite Bronze Co., 880 E. 72nd, Cleveland, O.
Electric Railway Equipment Co., 30 Church, New York, N. Y.
Elreco. See Electric Railway Equipment Co.
Graphalloy. See Graphite Metallizing Co.
Graphite Metallizing Co., Yonkers, N. Y.
Lubrite. See Merriam Bros., Yonkers, N. Y.
Merriam Bros., 185 Amory, Boston, Mass.
Metal Saw & Machine Co., Springfield, Mass.
Moraine Products Co., First & Foundry Sts., Dayton, O.
Neveroil Bearing Co., Wakefield, Mass.
Nolu Oilless Bearing Co., 6 E. Johnson, Philadelphia, Pa.
O. & S. Bearing Co., 515 S. Artillery, Detroit, Mich.
Reliance. See Metal Saw & Machine Co.
Selb Lignum-Vitae Woodturning Co., 98 Boyd Ave., Jersey City, N. J.
United States Graphite Bearing Co., Saginaw, Mich.

BEARINGS AND BUSHINGS
(For Armature Shafts.)
Adjustable Bearing Co., 101 Transportation Bldg., Indianapolis, Ind.
Ajax Metal Co., Philadelphia, Pa.
American Bronze Corp., Berwyn, Pa.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bunting Brass & Bronze Co., Toledo, Ohio.
Damascus Bronze Co., Pittsburgh, Pa.
Durex. See Moraine Products Co.
Flood City Mfg. Co., Johnstown, Pa.
Johnson Bronze Co., New Castle, Pa.
Lumen Bearing Co., Buffalo, N. Y.
Moraine Products Co., Dayton, O.
National Bearing Metal Corp. (More-Jones Brass & Metal Div.), 4930 Manchester Ave., St. Louis, Mo.
United States Graphite Co., Saginaw, Mich.

BELTING, Chain Transmission. See Chain, Power Transmission.

BELTS, Rubber
Molded Cord Rubber Belts for Electrical Appliances.
Fay Rubber Products Co., Elyria, O.
Glimer Co., L. H. (Tacony), Philadelphia, Pa.

BENDERS, Coil Loop
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.

Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Segur. See Electric Service Supplies Co.

BENDING. See Punching & Bending.
BINDING POSTS. See Posts, Binding.

BLADES, Fan
Estes & Sons, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Spee-Dee Elec. Mfg. Co., 190 Lafayette, New York, N. Y
Torrington Mfg. Co., Torrington, Conn.

BLUESTONE. See Chemicals, Battery.
BOARD, Fuller. See Cloth and Paper.
BOARD, Press. See Cloth and Paper.
BOWL HOLDERS. See Fixture Fittings.
BOX & CABINET BUSHINGS. See Bushings, Box & Cabinet.

BOX BOARD
Container Corp. of America, 111 W. Washington, Chicago.
Mid-West Box Co., 111 W. Washington, Chicago.

BOXES, Fibre
Container Corp. of America, 111 W. Washington, Chicago.
Corribre. See Container Corp. of America.
Mid-West Box Co., 111 W. Washington, Chicago.

BOXES, Sheet Steel. See Cabinets, Sheet Steel.
BOXES, Wood. See Cabinets & Boxes, Wood.

BOXES AND WRAPPERS
Brown & Bailey Co., 417 N. Eighth, Philadelphia, Pa.
Bulldog. See Pittsburgh Corrugated Paper Box Co.
Campbell Paper Box Co., South Bend, Ind.
Consolidated Paper Co., Monroe, Mich.
Container Corp. of America, 111 W. Washington, Chicago.
Gair Co., Robert, 420 Lexington Ave., New York. (Boxes.)
Gator-Hide Kraft. See International Paper Co.
Hinde & Dauch Paper Co., 325 Decatur, Sandusky, Ohio.
Huntington Paper Box Co., Huntington, Ind.
International Paper Co., 100 E. 42nd, New York, N. Y.
Lake Lithographing Co., 2570 Superior Ave., Cleveland, O. (Display Cartons.)
Mid-West Box Co., 111 W. Washington, Dept. 36, Chicago.
National Folding Box Co., New Haven, Conn. (Cartons.)
Pittsburgh Corrugated Paper Box Co., Pittsburgh, Pa.
River Raisin Paper Co., Monroe, Mich.
Sefton Mfg. Co., 59 E. Madison, Chicago, Ill.
Shuttleworth Carton Co., 474 W. Broadway, New York.

BRACKETS, Instrument
For Suspending Meters to Station Switchboard.
General Electric Co., Schenectady, N. Y.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

BRAIDING MACHINES. See Wire Manufacturing Machines.

BRASS TUBING. See Tubing, Brass and Copper.

BRASS, BRONZE AND COPPER
Sheet, Rod, Bar.
American Brass Co., 25 Broadway, New York, N. Y.
American Nickeloid Co., Peru, Ind.
Anaconda. See American Brass Co.
Baltimore Brass Co., 1212 Wicomico, Baltimore, Md.
Baltimore Copper Mills, (Div. of General Cable Corp.) Baltimore, Md.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bohnalite. See Bohn Aluminum & Brass Corp.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Dallas Brass & Copper Co., 820 Orleans, Chicago, Ill.
Nickeloid. See American Nickeloid Co.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.
Titan Metal Mfg. Co., Bellefonte, Pa. (Rods and Forgings.)

BREAKERS, Circuit. See Circuit Breakers.
BRIDGES, Wheatstone. See Instruments, Laboratory Standard.
BRONZE. See Brass, Bronze and Copper; also Castings.
BRONZE, Phosphor. See Phosphor Bronze.
BRONZE POWDER, Aluminum. See Aluminum.
BRUSH HOLDERS. See Brushes, Commutator.
BRUSHES, Carbon. See Brushes, Commutator.
Graphite. See Brushes, Commutator.
Metal Graphite. See Brushes, Commutator.

BRUSHES, COMMUTATOR
(Brushes, Brush Holders and Flexible Leads.)

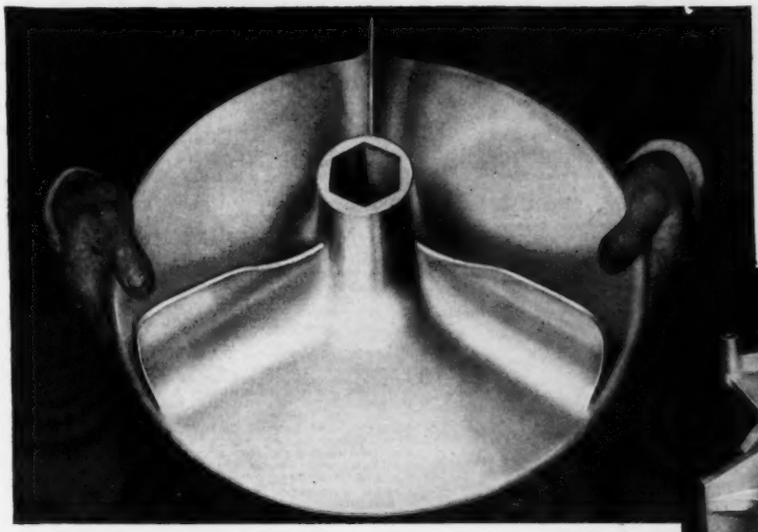
Brush Holders	See H
Carbon, Graphite, Metal Graphite	See C
Flexible Leads and Pig Tails	See L
Sheet Metal	See S
Wire Gauze	See W

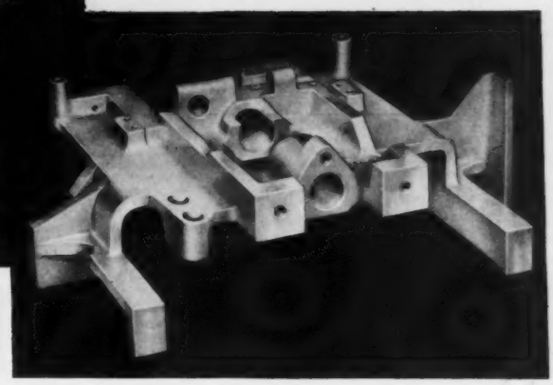
Automotive Mfg. Co., Kansas City, Mo. . . . . H . .
B. B. B. See Becker Bros. Elec'l Corp.
Baylis Co., Bloomfield, N. J. . . . . H . .
Becker Bros. Elec. Corp., 23 N. Jefferson, Chicago, Ill. . . . . C W S H L
Blanck & Carrier Corp., 115 W. 63rd, New York, N. Y. . . . . C . . . . .
Boxill-Bruel Carbon Co., Columbia Park, O. C . . . H . .
Calebaugh Self-Lubricating Carbon Co., 1503 Columbia Ave., Philadelphia, Pa. . . . . C . . . . .
Carbon Engrg. Co., Olinger, Wis. . . . . C L
Carbon Laboratories Co., 5005 Euclid Ave., Cleveland, O. . . . . C . . . . .
Carbon & Graphite Corp., 227 West Broadway, New York, N. Y. . . . . C . . . . .
Carenco. See Carbon Engineering Co.

ALUMINUM

Alumac Die Castings

Will help you meet competition





At left: *An Alumac die cast "dolly" or agitator for washing machine. This casting costs its user less than he would have to pay for the same part made in any other material or by any other method.*

Below: *Here, by contrast, is a very complicated part of the "Teletype"—requiring the accurate casting-in of 26 holes. A difficult task easily accomplished by Alumac Die Casting.*

FOR the manufacturer who is striving to produce at less cost than his competitors, Alumac Die Castings (of Alcoa Aluminum) make possible a very appreciable saving.

They are just as strong, and yet they weigh less than half as much as castings made from other metals. They enable speedier handling, both in production and in shipping.

Alumac Die Castings permit close tolerances of ± .0015 inch per linear inch, and they allow holes, lands, grooves and inserts to be cast into the part. Afterward they require less machining, polishing and costly hand operations, which also effects a substantial saving.

From Aluminum Company of America you can obtain die castings in all other die casting metals of a quality that insures accuracy, uniformity and economy.

One of our Die Casting Specialists will be glad to discuss with you the possibilities of Alumac Die Castings for lowering your costs and speeding up your production. His services are free for the asking.

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2471 Oliver Building, Pittsburgh, Pa.
Offices in 18 Principal American Cities
Aluminum in Every Commercial Form

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ALUMAC
TRADE MARK
DIE CASTINGS
For Strength, Lightness, Economy

Die Castings

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Advance Tool & Die Casting Co.
1654-60 Holton St., Milwaukee, Wis.
Edgewood 284

DIE CASTINGS

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OUR 36 years' experience in DIE-CASTING enables us to give you QUALITY and SERVICE. ALLOYS the very best used in all castings closely checked by our own METALLURGIST. Let our engineering department explain the savings possible in the use of die castings. We design and make our own DIES. QUOTATIONS made on parts NICKEL or CHROME plated. GOOD WILL reflects as an index to our large number of satisfied customers.

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826 Gifford St., Syracuse, N. Y.
Pioneers of the Die-Casting Industry

DIE MOLDED CASTINGS

IN

Aluminum, Tin, Zinc and Lead Alloys

Send Samples or Blueprints for Quotations

Get Our Prices They Will Interest You

BADGER DIE CASTING CO.,
156 East Buffalo St., Milwaukee, Wis.

BRUSHES, Commutator—Continued
Chapin Co., Chas. E., 227 Fulton St., New York, N. Y. ..... C W S .. L
Columbia Machine Wks., & M. I. Co., 263 Chestnut, Brooklyn, N. Y. .... H ..
Cooley Mfg. Co., 98 Park Place, New York .. W .. .. ..
Diamond C. See Chapin Co., Chas. E.
Dixon Crucible Co., Joseph, Jersey City.....
Electra. See Automotive Mfg. Co.
Electric Accessories Co., 310 York Ave., Philadelphia, Pa. ..... H .
Electro-Nite Carbon Co., 308 N. Fourth, Philadelphia, Pa. .....
Eureka Copper Products Corp., North East, Pa. ..... W S H .
Fleck Carbon Co., 508 Broome, New York C .. ..
General Electric Co., Schenectady, N. Y..... C .. .. H ..
Graphalloy. See Graphite Metallizing Corp.
Graphite Metallizing Corp., 1040 Nepperhan Ave., Yonkers, N. Y. ..... C .. .. H ..
Henrite Products Co., 98 Park Place, New York, N. Y. ..... C .. .. ..
Holland Trolley Supply Co., 1623 E. 43rd, Cleveland, Ohio ..... H ..
Jeandron, W. J., 345 Madison Ave., New York, N. Y. (Imported.) ..... C .. .. ..
Keystone Carbon Co., 4630 N. 11th, Philadelphia, Pa. ..... C .. ..
Kohlenite Products Co., 417 W. 28th, New York, N. Y. ..... C .. ..
Le Carbone. See Jeandron, W. J.
Le Valley Vitae Carbon Brush Co., 4851 Grand Central Terminal, New York, N. Y. C .. ..
Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich. ..... C .. ..
Morganite Brush Co., 33-02 48th Ave., Long Island City, N. Y. ..... C .. ..
National Carbon Co., Cleveland, O. ..... C .. ..
New Process Carbon Co., 1503 Columbia Ave., Philadelphia, Pa. ..... C L
No Spark. See Calebaugh Self-Lubricating.
Ohio Carbon Co., 8215 Almira Ave., Cleveland, Ohio ..... C W L
Ohio Elec. Specialty Mfg. Co., Troy, O..... .. W .. .. ..
Perfection Supply Co., 98 Park Pl., New York, N. Y. ..... C W S H L
Pittsburgh Carbon Brush Co., 127 Fancourt, Pittsburgh, Pa. ..... C .. ..
Pure Carbon Co., Wellsville, N. Y..... C W S .. L
Pyramid. See National Carbon Co.
Reaction. See Baylis Co.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y. .... W L
Salem Electrical Supply Co., Salem, Mass. .. W .. .. ..
Seabury, Ralph L., Factories Bldg., Toledo, O. C .. ..
Snarr & Co., Geo. W., 110 S. Ninth, St. Louis, Mo. ..... C .. ..
Spee-Dee Elec. Mfg. Co., 199 Lafayette, New York, N. Y. ..... C L
Speer Carbon Co., St. Mary's, Pa. ..... C .. ..
Stackpole Carbon Co., St. Mary's, Pa..... C .. ..
Sterling. See Carbon Laboratories Co.
Superior Carbon Products Co., North Rd., Poughkeepsie, N. Y. ..... C .. ..
U. S. Graphite Co., Saginaw, Mich..... C .. ..
Universal. See Graphite Metallizing Corp.
Weber Elec. Wks., Brooklyn Sts., Cleveland. C L

BRUSHES, PNEUMATIC SPRAYING. See Spraying Outfits.

BRUSHES FOR VACUUM CLEANERS

Omaha Brush Co., 320 N. 15th, Omaha, Neb. (Brushes rebristled.)
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUGGIES, Armature. See Lifts, Armature.

BULBS, Glass

For Incandescent Lamps and Tubes.
Almo Mfg. Co., 38 Crawford, Newark, N. J.
Corning Glass Wks., Corning, N. Y.
Fayette Glass Bulb Co., 229 21st, Brooklyn, N. Y.
Libby Glass Co., Toledo, O.

BUNCHING MACHINES. See Wire Manufacturing Machines.

BUSHINGS, SHAFT. See Bearings and Bushings.

BUSHINGS, Box and Cabinet, Porcelain

Appleton Electric Co., 1704 Wellington Ave., Chicago, Ill.
Columbia Metal Box Co., 226 E. 144th St., New York, N. Y.
Harter. See Multi Elect. Mfg. Co.
Knox Porcelain Corp., Knoxville, Tenn.
Mineralac Electric Co., 25 N. Peoria, Chicago, Ill.
Multi Electric Mfg. Co., 210 N. Ogden Ave., Chicago, Ill.
Nelson Elec. Co., Plant City, Fla.

CABINET GRILL CLOTH. See Cloth, Untreated.

CABINETS, Fibre

Diamond State Fibre Co., Bridgeport, Pa.
Vulcawood. See Diamond State Fibre Co.

CABINETS, Refrigerator. See Refrigerator Cabinets.

CABINETS, Sheet Steel

Stamped and Turned-up Boxes and Cabinets.
Acme Blow Pipe & Sheet Metal Wks., New Orleans, La.
Adam Electric Co., Frank, St. Louis, Mo.
American Steel Furniture Co., 27 W. 24th, New York, N. Y.
Aurora Steel Products Co., Aurora, Ill.
Benjamin Elec. Co., 1378 E. 16th, Los Angeles, Cal.
Berks Engineering Co., Reading, Pa.
Berthold Elec. Co., Geo., 555 W. Monroe, Chicago, Ill.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
C. & P. Electric Wks., Springfield, Mass.
Cleveland Switchboard Co., 2825 E. 79th, Cleveland, O.
Coast Specialty Co., 72 E. Sixth, Portland, Ore.
Cole Metal Products Co., 33 Crescent, Long Island City.
Columbia Elec. Mfg. Co., 59 Columbus Sq., San Francisco, Cal.
Columbia Metal Box Co., 226 E. 144th, New York, N. Y.
Columbian Steel Tank Co., 1505 W. 12th, Kansas City, Mo.
Commercial Mfg. & Supply Co., 1443 Delaware St., Denver.
Diamond Elec'l Mfg. Co., 1330 E. 16th, Los Angeles, Cal.
Dowman Dozier Mfg. Co., 1314 Murphy Ave., S. W., Atlanta, Ga.
Electric Panelboard Co., 426 Exchange, Rochester, N. Y.
Electric Apparatus Co., 702 N. Halsted, Chicago, Ill.
Federal Steel Products Co., 2 Ave. L, Newark, N. J. (Polarized Boxes.)
Fouch Elec. Mfg. Co., 105 N. Ninth, Portland, Ore.
Greater New York Metal Box Co., Inc., 143 W. 19th, New York.
Green Elec. Co., 31 N. Water, Rochester, N. Y.
Gurney Sheet Metal Wks., 718 E. 4th, Long Beach, Cal.
Hauer, J. B., Driggs Ave. and N. 11th, Brooklyn, N. Y.
Holzer Sheet Metal Wks., Inc., New Orleans, La.
Hough Mfg. Co., 2520 24th, Detroit, Mich.
Isert Co., J. H., 1234 Rowan, Louisville, Ky.
Karp Metal Products Co., 129 30th, Brooklyn, N. Y.
Kirtland Elec. Construction Co., 34 Herkimer, Albany, N. Y.
Large-Dail Mfg. Co., 406 Cherry St., Philadelphia.
Leonard Elec. Mfg. Co., 2907 Perkins Ave., Cleveland, O.
Lexington Elec. Products Co., 419 E. 24th, New York, N. Y.
Lorentzen, H. K., 155 Leonard, New York, N. Y.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Mansfield Elec. Hardware Co., Longview Ave., Mansfield, O.
Metropolitan Elec. Co., 2914 First Ave., S., Seattle, Wash.
Metropolitan Elec. Products Co., Blvd. at 14th, Long Island City, N. Y.
Milwaukee Vault & Cabinet Co., 521 Market, Milwaukee.
Mosher, S. L., 1951 Lawrence, Denver, Colo.
National Metal Box Co., Van Dyke & Ferris Sts., Brooklyn.
Newman Elec. & Mfg. Co., Eau Claire, Wis.
Parr Metal Products Corp., 3519 41st, Long Island City, N. Y.
Penn Electrical Co., 35 Water, Irwin, Pa.
Powerlite Switchboard Co., 4149 E. 79th, Cleveland, O.
Rezich. See Holzer Sheet Metal Works.
Robbins & Myers, Inc., Springfield, O.
Security. See Aurora Steel Products Co.
Standard Metal Box Corp., 950 Grand St., Brooklyn, N. Y.
Star Metal Box Co., 238 46th, Brooklyn, N. Y.
Superior Switchboard & Devices Co., 420 Schroyer Ave., Canton, O.
Tanner & Co., Wm. F., 511 S. Sharp, Baltimore, Md.
United Metal Box Co., 473 President, Brooklyn, N. Y.
United Sheet Metal Wks., 575 Howard, San Francisco.
Wadsworth Elec. Mfg. Co., Covington, Ky.
Wurdack Elec. Mfg. Co., 4444 Clayton Ave., St. Louis, Mo.

CABINETS AND BOXES, Wood

Ampere. See Donehue Lumber Co.
Aston Cabinet Mfrs., 1223 W Lake, Chicago, Ill.
Boehm Cabinet Co., J., 2216 W. 63rd St., Cleveland, O.
Buckeye Mfg. Co., Springfield, O.
Carolina Wood Products Co., Asheville, N. C.
Carrom Co., Ludington, Mich.
Caswell-Runyon Co., Huntington, Ind.
Cheney Piano Action Co., A. C., Castleton, N. Y.
Clinton Corp., 342 Madison Ave., New York, N. Y.
Corlieth Cabinet Mfg. Co., St. Mary's, Pa.
Corv Cabinet Corp., Springfield, Mo.
Detrex Co., Geo., Henderson, Ky.
Donehue Lumber Co., Smith and State, Perth Amboy, N. J.
Efein & Sons, Frederick, 44 Central Ave., Brooklyn, N. Y.
Empire-United Hat Block Co., 312 E. 22nd, New York.
Estes & Sons, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Excello Products Corp., 4836 W. 16th, Cicero, Ill.
Grand Rapids Furniture Co., Grand Rapids, Mich.
Harper Mfg. Co., Cassopolis, Mich.
Hickory Box Co., Hickory, N. C.
Hubbell, H. L., 59 Market Ave., N. W., Grand Rapids.
Interstate Woodworking Co., 46 Wooster, New York, N. Y.
Karpen. See Studner Bros.
King Mfg. Corp., Rano & Crowley, Buffalo, N. Y.
Klumpp Sons, John G., 13 Baxter, New York, N. Y.
National Cabinet Co., New Philadelphia, O.
New England Box Co., Greenfield, Mass.
Oneida Cabinet Corp., Oneida, N. Y.
Ottawa Furniture Co., Holland, Mich.
Pooley Co., 16th & Indiana Ave., Philadelphia, Pa.
Radio Allied Mfrs. Corp., 1340 S. Michigan Ave., Chicago.
Radio Cabinet & Equipment Co., 1504 Vine, Philadelphia.
Radio Mfg. Co., Div. of Pilliod Lumber Co., Swanton, O.
Radio Master Corp., Bay City, Mich.
Red Lion Cabinet Co., Red Lion, Pa.
R. E. Z. Cabinet Co., 54 North, Boston, Mass.
Rockford Sales Corp., 206 Lexington Ave., New York, N. Y.
Schulz Bros., 152 Chambers, New York, N. Y.
Signal Elec. Mfg. Co., Menominee, Mich.
Southern Toy Co., Hickory, N. C.
Specialty Display Case Co., Kendallville, Ind.
Stradivara Co., Coshocton, Ohio.
Stettner Phonograph Corp., 318 E. 75th, New York.
Studner Bros., 67 W. 44th, New York, N. Y.

DIE CASTINGS

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Twin City Die Castings Co.
Talmage and 33rd Aves., S. E.
MINNEAPOLIS, MINN.

Superior Cabinet Corp., 206 Broadway, New York, N. Y.
Syracuse Screen & Grille Co., North Manchester, Ind.
Tessier Bros., 355 Bridge, Northampton, Mass. (Radio.)
Trenton Wood Specialty Co., Stokes Ave. and P. R. R., Trenton, N. J.
Udell Wks., 28th and Barnes Ave., Indianapolis, Ind.
West Box Co., 235 Liberty, Springfield, Mass.

CABLE ARMORING MACHINES. See Wire Manufacturing Machines.

CABLE TEST SETS. See Instruments, Portable and Switchboard.

CABLING MACHINES. See Wire Manufacturing Machines.

CANDLES, Fixture

Glass, Fibre Paper.
Brandywine Fibre Products Co., 1402 Walnut, Wilmington.
Cleveland Container Co., 10800 Berea Rd., Cleveland, O.
Fibro Products Co., New Bedford, Mass.
Franklin Fibre Specialty Co., 173 Lafayette, New York, N.Y.
Remington Mfg. Co., 939 Barnum Ave., Bridgeport, Conn.
Seamless. See Fibro Products Co.

CANOPY (Canopies). See Fixture Fittings.
Insulators. See Insulators.
Switches. See Switches, Snap.

CAPACITORS, RADIO. See Radio Circuit Components.

CARBON, Powdered

Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich.

CARBONS, Battery. See Carbons, Arc Light. See Carbons.

CARBONS

Battery Arc Light.
Blanck & Carrier Corp., 115 W. 63rd, New York, N. Y.
Columbia. See National Carbon Co.
Daylight. See National Carbon Co.
Lessing Battery. See Blanck & Carrier Corp.
Nuernberg Battery. See Blanck & Carrier Corp.
National Carbon Co., Cleveland, Ohio.
Oretip. See National Carbon Co.
Silvertip. See National Carbon Co.
Speer Carbon Co., St. Mary's, Pa.
Stackpole Carbon Co., St. Mary's, Pa.

CARTONS. See Boxes and Wrappers.

CASEIN PLASTICS. See Molded Insulation.

CASES, Eliminator. See Cases, Eliminator.
Flashlight. See Cases, Flashlight.

CASES, Eliminator

Brumberger Co., 252 Pearl, New York, N. Y.
Grand Sheet Metal Wks., 176 Grand, New York, N. Y.
Luna Tin Mfg. Co., 547 W. 21st, New York, N. Y.

CASES, Flashlight

Bridgeport Brass Co., 744 E. Main, Bridgeport, Conn.
Lincoln Fibre Specialty Co., Newport, Del.
St. Louis Paper Can & Tube Co., St. Louis, Mo.
Underwood Battery Co., 1250 Ontario, Cleveland, O.

CASTINGS, Aluminum. See Castings, Aluminum. Also
Castings, Copper, etc.
Brass. See Castings.
Bronze. See Castings.
Copper. See Castings.
Die. See Castings, Die.
Monel Metal. See Castings.
Steel. See Castings, Steel.
White Metal. See Castings.

CASTINGS, Aluminum

Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh.
Bohm Aluminum & Brass Corp., Detroit, Mich.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
Quality Aluminum Casting Co., Waukesha, Wis.
Veco Mfg. Co., South Norwalk, Conn.

CASTINGS

Copper, Brass, Bronze, Monel Metal, White Metal.
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
Central Pattern & Foundry Co., 3737 S. Sacramento Ave., Chicago, Ill.
Chase Brass & Copper Co., Waterbury, Conn.
Faries Mfg. Co., Decatur, Ill.
McGill Metal Co., Valparaiso, Ind.
Ohio Pattern Wks. & Fdy. Co., 2730 Spring Grove Ave., Cincinnati, O.
Rabun Bronze Foundry, 617 West Belgrave, Huntington Park, Cal.
Sterling Art Metal Wks., 40 Purvis, Long Island City, N. Y.

CASTINGS, Die

Advance Tool & Die Casting Co., 1654 Holton, Milwaukee, Wis.
Alemite Die-Casting & Mfg. Co., 2640 Belmont Ave., Chicago, Ill.
Allied Die-Casting Corp., Long Island City, N. Y.
Alumac. See Aluminum Co. of America.
Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh.
Aluminum Industries, Inc., 2438 Beekman, Cincinnati, O.
American Die Casting Co., 2040 Dominick, Chicago, Ill.
Badger Die Casting Co., 156 East Buffalo, Milwaukee, Wis.
Barnhardt Bros. & Spindler, Monroe & Throop St., Chicago.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Do-Dit. See Doehler Die Casting Co.
Doehler Die Casting Co., 386 Fourth Ave., New York, N. Y.
Franklin Die Casting Corp., 826 Gifford, Syracuse, N. Y.
Illinois Die Castings Co., 503 S. Jefferson, Chicago, Ill.
Milwaukee Die Casting Co., 289 Fourth, Milwaukee, Wis.
Newton Die Casting Corp., 146 Munson, New Haven, Conn.
Perfection Die Casting Corp., 406 Lakeside Ave., N. W., Cleveland, O.
Permite. See Aluminum Industries, Inc.
Steward Die Casting Co., 4500 Fullerton Ave., Chicago, Ill.
Superior Die Casting Co., 875 E 70th, Cleveland, Ohio.
Twin City Die Castings Co., Talmadge and 33rd Aves., S. E., Minneapolis, Minn. (White Metal).

CASTINGS, Gray Iron

American Engineering Co., Philadelphia, Pa.
Athens Foundry Co., Athens, Pa.
Barlow Foundry Co., 551 N. J. R. R. Ave., Newark, N. J.
Barnett Foundry Co., Newark, N. J.

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CASTINGS, Gray Iron—Continued
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
North Wales Mach. Foundry Co., North Wales, Pa.
Sacks Iron Foundry, L., 357 Wilson Ave., Newark, N. J.
Snead & Co., Pine St., Jersey City, N. J.
St. Louis Malleable Castings Co., 7701 N. Conduit Ave., St. Louis, Mo.

CASTINGS, Steel

Bonney-Floyd Co., Columbus, Ohio.
Eastern Steel Casting Co., Ave. L & Edward St., Newark.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Riverside Steel Casting Co., Jacobus Ave., Kearney, N. J.

CEMENT, Commutator

Armstrong. See Electric Power Maintenance Co.
Conductalute. See Technical Products Co.
Early, Edward E., 1129 W. Fifth, N. W., Canton, O.
Electric Power Maintenance Co., 21 N. Third, Minneapolis.
Imperial. See Martindale Electric Co.
Martindale Electric Co., 1262 W. Fourth, Cleveland, O.
Mitchell Rand Mfg. Co., 19 Vesey, New York, N. Y.
Perce-Lute. See Perfection Supply Co.
Perfection Supply Co., 98 Park Pl., New York, N. Y.
Plas Mica Co., 26 St. Andrews Place, Yonkers, N. Y.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh, Pa.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

CEMENT, Liquid Porcelain

Anchorlute. See Technical Products Co.
Fire Lute. See Technical Products Co.
Insa-Lute. See Technical Products Co.
Okonite Co., Passaic, N. J.
Repairet Mfg. Co., Milwaukee, Wis.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh, Pa.
Thermoid. See Technical Products Co.
CHAIN, Chandelier (Fancy). See Crystals, Chandelier.
CHAIN DRIVES. See Chain, Power Transmission.

CHAIN, Fixture

Acco. See American Chain Co.
American Chain Co., Bridgeport, Conn.
Chase Brass & Copper Co.
Eastern Chain Works, 309 E. 22nd St., New York, N. Y.
Faries Mfg. Co., Decatur, Ill.
Globe Metal Mfg. Co., 2122 E. Hazard, Philadelphia, Pa.
H. & O. Chain Co., So. Norwalk, Conn.
Newark Metal Mfg. Co., 22 S. 6th, Newark, N. J.
Plume & Atwood Mfg. Co., Waterbury, Conn.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Steele & Johnson Mfg. Co., Waterbury, Conn.
Universal Metal Chain Co., 75 Clymer, Brooklyn, N. Y.

CHAIN, Power Transmission

Baldwin Chain & Mfg. Co., Worcester, Mass.
Boston Gear Wks. Sales Co., Norfolk Downs, Mass.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Link-Belt Company, 910 S. Michigan Ave., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Ramsey Chain Co., Inc., Albany, N. Y.
Reeves Pulley Co., Columbus, Ind.
Renold Boston. See Boston Gear Wks.
Union Chain & Mfg. Co., Sandusky, O.
Whitney Mfg. Co., Hartford, Conn.

CHAIN, Socket

American Ball Chain Works, 13 Wooster St., New York.
Read Chain Mfg. Co., Bridgeport, Conn.
H. & O. Chain Co., South Norwalk, Conn.
CHANDELIER BEADS. See Crystals, Chandelier.
CHANDELIER CRYSTALS. See Crystals, Chandelier.
CHANDELIER FRINGE. See Crystals, Chandelier.

CHARGERS, Magnet

Charging, Remagnetizing.
Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Cowie Elec. Co., E. S., 1822 Wyandotte, Kansas City, Mo.
Fore Elec. Mfg. Co., 5255 Wabada Ave., St. Louis, Mo.
Serwell Sales Corp., 1749 N. Winchester Ave., Chicago.
Valley Electric Co., 4221 Forest Park Blvd., St. Louis, Mo.

CHEMICALS, Battery

Electrolyte, Battery Salts, Battery Oxides, Sal Ammoniac, Bluestone, Manganese.
Cooper & Co., Charles, 194 Worth, New York, N. Y.
Eagle-Picher Lead Co., 134 N. LaSalle, Chicago. (Oxide.)
Eimer & Amend, 205 3rd Ave., New York, N. Y.
Electro Chemical Co., 115 W. Court St., Dayton, O.
General Metallic Oxides Co., Jersey City, N. J.
Globe Chemical Co., Murray Rd. and Big Four R. R., Cincinnati, O.
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Kalbfleisch Corp., 200 5th Ave., New York, N. Y.
Klipstein Co., 644 Greenwich, New York, N. Y.
Merrimac Chemical Co., 148 State, Boston, Mass.
Powers-Weightman-Rosengarten Co., Philadelphia, Pa.
Voltah. See Powers-Weightman-Rosengarten Co.
Wah Chang Trading Corp., 233 Broadway, New York, N. Y.

CHEMICALS, Refrigeration

Ansul Chemical Co., Marinette, Wis.
Arctic. See Roessler & Hasslacher Chemical Co.
Carbide & Carbon Chemicals Corp., 30 E. 42nd, New York, N. Y. (Butane & Isobutane.)
Dry Ice Corp. of America, 50 E. 42nd, New York, N. Y.
Roessler & Hasslacher Chemical Co., 709 Sixth Ave., New York, N. Y. (Methyl Chloride, Ethyl Chloride.)
Virginia Smelting Co., West Norfolk, Va. (Sulphur Dioxide.)
Chromium Plating. See Plating & Finishing.

CHUCKS, Magnetic

J & H Elec. Co., 161 Clifford, Providence, R. I.
Simmons. See Taft-Pierce Mfg. Co.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S. (Rockdale), Worcester, Mass.

CIRCUIT BREAKERS

Air and Oil Circuit Breakers and Oil Break Switches.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Anderson Mfg Co., Albert & J. M., 239 A, Boston, Mass.
Automatic Reclosing Circuit Breaker Co., Columbus, O.
Automatic Switch Co., 617 E. Larned, Detroit, Mich.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Condit Elec'l Mfg. Corp., 838 Summer St. (South Boston), Boston, Mass.
Cramblett Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
General Electric Co., Section W-233, Merchandise Dept., Bridgeport, Conn.
Hart & Hegeman Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
High Tension Elecl. Specialty Co., 500 Washington, Abington, Mass.
Hitesco. See High Tension Elecl. Specialty Co.
H. & H. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Inducto-therm. See Allen-Bradley Co.
I. T. E. Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia, Pa.
Line Material Co., South Milwaukee, Wis. (Oil Switches.)
Maple Co., R. H., Indianapolis, Ind.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Minibraker. See Burke Controller Co.
Roller-Smith Co., 220 Broadway, New York, N. Y.
Sentinel. See Westinghouse Elec. & Mfg. Co.
Takamine Corp., 208 Rawson, Long Island City, N. Y.

Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
U-Re-Lite. See I. T. E. Circuit Breaker Co.
Ward Leonard Elec. Co., Mount-Vernon, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
CIRCUIT TESTERS. See Testers, Fuse and Circuit.
CLEANER BAGS, Vacuum. See Bags, Vacuum Cleaner.
CLEANER BRUSHES, Vacuum. See Brushes for Vacuum Cleaners.

CLEANERS, Metal

Oakite Products, Inc., 26 Thames, New York, N. Y.
CLIPS, Fuse. See Fuse Clips.

CLIPS, Heater Plug

Gray Bros. Co., Piano, Ill.
CLOCK SWITCHES. See Switches, Time.
CLOTH GEARS. See Gears and Pinions, Composition.
CLOTH LOUD SPEAKER DIAPHRAGM. See Cloth, Untreated.
CLOTH RADIO GRILL. See Cloth, Untreated.

CLOTH, Untreated

Doyle & Co., John, 112 Duane, New York, N. Y.
Canvas, "Aeroplane Cloth," Cotton Duck, Drill, Diaphragm Cloth, Grill Fabrics, etc.
Pindall Fabrics Corp., 200 Madison Ave., New York, N. Y. (Grill Cloth).

CLOTH AND PAPER, Insulating

Cloth, Insulated ..... See C
Paper, Insulated ..... See P
Fibre Paper (Fish Paper) ..... See F
Press Board (Fuller Board) .... See B
Silk ..... See S

Acme Wire Co., New Haven, Conn.	C	S	P	. . .
Armco. See Rogers Paper Mfg. Co.				
Armatite. See Mica Insulator Co.				
Brand & Co., William, 368 4th Ave., New York	. . .	. .	P	. . .
Carboloid Products Corp., 15 Park Row, New York, N. Y.	. . .	. .	P	. . .
Case Brothers, Inc., Highland, Park, Conn.	. . .	. .	P	. . B
Case Mfg. Co., Unionville, Conn.	. . .	. .	P	. . .
Case & Hinkley Press Paper Co., Oneco, Conn.	. . .	. .	P	. . .
Celoron Co., Bridgeport, Pa.	. . .	. .	P	F B
Chicago Mica Co., 345 Campbell, Valparaiso, Ind.	. . .	C	. .	. . .
Dexstar. See Dexter & Sons.				
Dexter & Sons, C. H., Windsor Locks, Conn. (Condenser Tissue.)				
Diamond State Fibre Co., Bridgeport, Pa.	. . .	. .	P	. . .
Dielectric Mfg. Co., St. Louis, Mo.	. . .	C	S	P . . B
Electrite. See West Virginia Pulp & Paper Co.				
Fyberoid. See Wilmington Fibre Specialty Co.				
General Electric Co., Section I-483, Merchandise Dept., Bridgeport, Conn.	. . .	C	. .	P . . .
Hartford City Paper Co., Hartford City, Ind. (Glassine Condenser Tissue).				
Hewitt & Bros., C. B., 16 Ferry, New York	C	. .	P	. . .
Hi-Tex. See Stevens Paper Mills.				
Incella. See Tarentum Paper Mills Co.				
Irrington Varnish & Insulator Co., Irvington, N. J.	. . .	C	S	P . . .
Manning Paper Co., J. A., Troy, N. Y.	. . .	. .	. .	. . B
Mica Insulating Co., 200 Varick, New York	C	S	P	. . B
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.	. . .	. .	P	. . .
National Vulcanized Fibre Co., Wilmington, Del.	. . .	. .	. .	F . .
New Jersey Wood Finishing Co., Woodbridge, N. J.	. . .	C	. .	. . .

Ohmoid. See Wilmington Fibre Specialty Co.
Old Hick. See Hewitt & Bros., C. B.
Peerless. See National Vulcanized Fibre Co.

Rogers Fibre Co., 310 Lincoln, Boston, Mass.	. . .	. .	. .	F . .
Rogers Paper Mfg. Co., South Manchester, Conn.	. . .	. .	. .	. . B
Schweitzer, Inc., Peter J., 200 Fifth Ave., New York, N. Y. (Condenser Tissue.)	. . .	. .	. .	. . .
Scutan Co., 342 Madison Ave., New York	. . .	. .	P	. . .

Sico. See Standard Insulation Co.

Standard Insulation Co., Rutherford, N. J.	C	S	P	. . .
Sterling Fireboard Co., 501 Fifth Ave., New York. (Varnished Hard Fibreboard)	. . .	. .	. .	. . B

Sterlite. See Sterling Firebrand Co.

Stevens Paper Mills, Windsor, Conn.	. . .	. .	. .	. . B
Tarentum Paper Mills Co., Tarentum, Pa.	. . .	. .	P	. . .

Turbonite. See Brand & Co., Wm.

Union Mills Paper Mfg. Co., New Hope, Pa.	. . .	. .	P	. . .
Warren Mfg. Co., 342 Madison Ave., New York, N. Y.	. . .	. .	P	. . .
West Virginia Pulp & Paper Co., 200 5th Ave., New York	. . .	. .	. .	. . B
Wilmington Fibre Specialty Co., Wilmington, Del.	. . .	. .	P	. . .

CLUTCHES, Magnetic

Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis.

COIL (Coils).

Armature and Field. See Coils, Finished.
Choke (Power). See Fittings, High Tension.
Choke (Radio). See Radio Circuit Components.
Driers & Impregnators. See Ovens.
Electromagnet. See Coils, Finished.
Flatteners. See Rolls, Coil Flattening.
High Frequency. See Electro-Therapeutic; also Radio Circuit Components; also Ignition Outfits.
Impregnators, Vacuum. See Ovens, Industrial.
Induction. See Coils, Finished; also Electro-Therapeutic.
Loop Benders. See Benders, Coil Loop.
Medical. See Electro-Therapeutic.
Presses. See Presses, Armature Coil.
Radio. See Radio Circuit Components.
Removers. See Removers, Coil.
Resistance. See Units, Rods & Grids; also Radio Circuit Components.
Shaping Machines. See Shaping Machines, Coil.
Spark. See Ignition Outfits.
Spreaders. See Winding Machines, Armature & Field Coil.
Taping Machines. See Taping Machines, Coil.
Tesla. See Ignition Outfits.
Testers. See Testers, Coil; also Test Benches, Armature.
Winders, Armature & Field Coil. See Winding Machines, Armature & Field Coil.
Winders, Induction Coil. See Winding Machines, Industrial Coil.
Winding Forms. See Forms, Coil Winding.
Windings (Magneto). See Coils, Finished.
Wire Tension Devices. See Tension Devices, Coil Wire.

COILS, Finished

Armature, Field, Electromagnet and Induction Coils.
Acme Products Co., Boston, Mass.
Acme Wire Co., New Haven, Conn.
Aero-Call. See Aero Products, Inc.
Aero Products, Inc., 1772 Wilson Ave., Chicago, Ill.
Auth Electrical Specialty Co., 422 E. 53rd St., New York, N. Y.
A. & A. See Electrical Coil Winding Co.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Bunnell & Co., J. H., 32 Park Place, New York, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Cameron Elec. Mfg. Co., Ansonia, Conn.
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne.
Easton Coil Co., Easton, Pa.

Electric Heat Control Co., 5902 Carnegie Ave., Cleveland, O.
Electrical Coil Winding Co., 27th & Sanderson Sts., Camden.
Electrical Products Mfg. Co., Providence, R. I.
Marion Elec. Mfg. Co., 24 Cliff, Jersey City, N. J.
Modern Elec. Mfg. Co., 312 Mulberry, Toledo, Ohio.
National Elec. Corp., 226 High, Newark, N. J.
Pfifer Elec. Repair & Mfg. Co., 3610 Superior Ave., Cleveland, O.
Polymet Mfg. Co., 599 Broadway, New York, N. Y.
Robertson-Davis Co., 361 W. Superior, Chicago, Ill.
Robertson, Leo F., 536 West 22nd St., New York, N. Y.
Rome Wire Co. (Div. of General Cable Corp.), Rome, N. Y.
Service Magneto Engrg. Co., 397 Phillips, Toledo, O.
Stunz & Barron, 210 E. Pratt, Baltimore, Md.
Toledo Standard Commutator Co., 2342 Smead Ave., Toledo, O.
Universal Winding Co., Boston, Mass.
Varley Duplex Magnet Co., 15 Exchange Place, Jersey City, N. J. (Electromagnetic only).
Whittier & Ditmar, Inc., 1611 Beacon, Brookline, Mass.

COMMUTATOR

Bars. See Bars, Commutator.
Cement. See Cement, Commutator.
Dressers. See Stones, Commutator.
Lubricants. See Compounds, Commutator.
New. See Commutators.
Refilled. See Repairing and Second Hand.
Slotters. See Slotting Machines & Tools, Commutator.
Slotting Files. See Files, Commutator Slotting.
Soldering Machines. See Soldering Machines, Commutator.
Stones. See Stones, Commutator.
Tighteners. See Tighteners, Commutator.
Truing Devices. See Tools, Commutator Truing.

COMMUTATORS

Derby Commutator Co., Derby, Conn.
Eureka Copper Products Corp., North East, Pa.
Homer Commutator Co., Cleveland, Ohio.
COMMUTATOR BRUSHES. See Brushes, Commutator.
COMPOSITION PULLEYS. See Pulleys, Composition.
COMPOUNDS, Sealing. See Wax and Compounds.

CONDENSER UNITS, Refrigerator

Bush Mfg. Co., Hartford, Conn.
McCord Radiator & Mfg. Co., Riopelle & E. Grand Ave., Detroit, Mich.
Rome-Turney Radiator Co., Rome, N. Y.
CONDENSERS, Radio. See Radio Circuit Components.
CONDENSER TUBING. See Tubing, Brass and Copper.
CONTACT POINTS. See Points, Contact.
CONTAINERS, Shipping. See Fibre Board Products.

CONTROLLERS, Motor

Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Anderson & Co., C. J., 212 W. Austin, Chicago, Ill.
Automatic Switch Co., 154 Grand, New York, N. Y.
Betts, Inc., James H., 1393 Sedgwick Ave., New York, N. Y. (Traffic.)
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
B-Q Oil Burner Co., Stockton, Cal.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Condit Elec'l Mfg. Corp., 838 Summer St. (South Boston), Boston, Mass.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Dinkey. See Elec. Controller & Mfg. Co.
E C & M Youngstown. See Electric Controller & Mfg. Co.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.
Electrite. See Sundh Elec. Co.
Diamond Elec. Mfg. Co., 1330 N. 16th, Los Angeles, Cal.
General Electric Co., Schenectady, N. Y.
Horni Signal Mfg. Corp., 515 Greenwich, New York, N. Y.
Industrial Controller Co., S. Pierce & Hanover, Milwaukee, Wis.
Maimin Co., H., 251 W. 19th, New York. (Sewing Machines.)
Monitor Controller Co., 51 Gay, Baltimore, Md.
National Electric Controller Co., 5315 Ravenswood Ave., Chicago, Ill.
Refrigerating Specialties Co., 728 S. Sacramento Blvd., Chicago, Ill.
Rowan Controller Co., 306 N. Holliday, Baltimore, Md.
Square D Co., 6060 Rivard, Detroit, Mich.
Sundh Elec. Co., 209 Parkhurst, Newark, N. J.
Switcholene. See Condit Elec. Mfg. Co.
Thermaload. See Monitor Controller Co.
Trumbull Electric Mfg. Co., Plainville, Conn.
Uemco. See Union Elec. Mfg. Co.
Union Elec. Mfg. Co., Milwaukee, Wis.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
W. K. See Westinghouse Elec. & Mfg. Co.
COPPER. See Brass, Bronze and Copper; also Castings.
COPPER TUBING. See Tubing, Brass and Copper.
CORD TIPS. See Tips, Cord.

CORES, RESISTANCE COIL (Lava)

American Lava Corp., 1425 William, Chattanooga, Tenn.
Crescent. See M. Kirchberger & Co.
Es-El-Co. See Southern Lava Co.
Kirchberger & Co., M., 1425 37th, Brooklyn, N. Y.
Lavite. See Steward Mfg. Co.
Lavarock. See M. Kirchberger & Co.
Southern Lava Co., Rossville, Ga.
Steward Mfg. Co., D. M., Chattanooga, Tenn.
Tennessee Burner Mfg. Co., Chattanooga, Tenn.
XL. See Tennessee Burner Mfg. Co.

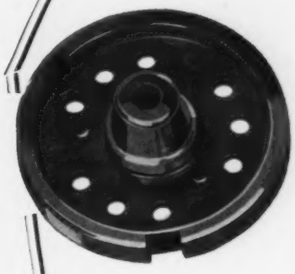
CORES, RESISTANCE COIL (Refractory Porcelain)

American Lava Corp., 1425 William, Chattanooga, Tenn.
Colonial Insulator Co., Akron, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O.
Elemite. See Louthan Mfg. Co.
Fireite. See Hartford Faience Co.
Hartford Faience Co., Hartford, Conn.
Louthan Mfg. Co., E. Liverpool, O.
Thermal Syndicate, 58 Schenectady Ave., Brooklyn, N. Y.
Vitreosil. See Thermal Syndicate.
Woolley, Inc., W. Douglas, East Liverpool, O.
COTTON DUCK. See Cloth, Untreated.
COTTON SLEEVING. See Tape, Cotton.
COUNTERS, Revolution. See Tachometers.

COUPLINGS, Shaft (Flexible-Insulated)

Bartlett Hayward Co., Baltimore, Md.
Bond Co., Charles, 617 Arch, Philadelphia, Pa.
Delbee Rubber Co., Syracuse, N. Y.
Falk Corp., Milwaukee, Wis.
Franke. See Smith & Serrell.
General Electric Co., Schenectady, N. Y.
Grundy. See Bond Co.
Lipe, W. C., Syracuse, N. Y.
Lovejoy Tool Wks., 319 W. Ohio, Chicago, Ill.
Mather. See Bond Co.
Nuttall Wks., of Westinghouse Elec. & Mfg. Co., McCandless Ave. & Harrison St., Pittsburgh, Pa.
Oneida. See Delbee Rubber Co.
Smith & Serrell, 24 Washington Pl., Newark, N. J.
Webster Mfg. Co., 1856 N. Kostner Ave., Chicago, Ill.
Wood's Sons Co., T. B., Chambersburg, Pa.
COVERING MACHINES, WIRE. See Wire Manufacturing Machines.

Satisfying the skeptics



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CUPS, Grease
Bowen Products Corp., Auburn, New York.
Gits Bros. Mfg. Co., 1960 S. Kilbourn Ave., Chicago, Ill.
Lunkenheimer Co., Cincinnati, Ohio.

CUPS, Oil
Gits Bros. Mfg. Co., 1960 S. Kilbourn Ave., Chicago, Ill.

CUT OUTS, Battery. See Switches, Battery.

CUTTING OUTFITS, Metal. See Welding and Cutting Outfits.

CRANES, Floor. See Lifts, Armature.

CRYSTALS, Chandelier
Crystals, Prisms, Beads, Chains, Fringes.
Crystal Venezia. See Harrison & Co., Arthur.
Friedlaender Co., 49 W. 23rd, New York, N. Y.
Harrison & Co., Arthur, 501 W. Washington Blvd., Chicago
Hirschberg, Shutz & Co., 268 4th Ave., New York, N. Y. (Fringes.)
Nelson Bead Co., 15 W. 37th, New York, N. Y. (Importer.)
Rialto Import Co., 112 W. 4th, New York, N. Y.
Schwartz Lighting Fixture Wks., 1341 Noble, Philadelphia
Wyle & Bros., J., 20 E. 27th, New York, N. Y.

CURRENT INDICATORS. See Instruments, Pocket.

DASHBOARD METERS. See Instruments, Portable and Switchboard.

DECALCOMANIA
Meyercord Co., 133 W. Washington, Chicago, Ill.
Novar. See Palm Fechteler & Co.
Palm Fechteler & Co., 67 5th Ave., New York, N. Y.

DIALS
Radio (Metal). See Radio Mountings.
Radio (Molded). See Radio Molded Parts.
Enameled. See Dials, Enameled.

DIALS, Enameled
Whittier Co., Horace B., Pequabuck, Conn.

DIAPHRAGM, Cloth. See Cloth Untreated.

DIE CASTINGS. See Castings, Die.

DIE MAKERS. See Dies, Die Makers.

DIES, Pipe. See Stocks, Dies and Reamers.

DIES, DIE MAKERS
Baumbach Mfg. Co., 1810 S. Kilbourn Ave., Chicago, Ill.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Danly Machine Specialties, Inc., 2104 S. 52nd Ave., Chicago, Ill.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Mareck & Nebel, 255 Greenwich, New York, N. Y.

DISCS, Armature
Steel Discs, Laminations, and Segments for Motors and Transformers.
American Stamping Co., 978 E. 64th, Cleveland, O.
Cleveland Armature Works, 4732 St. Clair Ave., Cleveland
Hercules Elec. Steel Corp., 145 Lafayette, New York, N. Y.
Lamination Stamping Co., 764 Windsor, Hartford, Conn.

DRAWING MACHINES, WIRE. See Wire Drawing Machines.

DRIVE SCREWS. See Screws, Drive.

DRIVES, CHAIN. See Chain, Power Transmission.

DYNAMOMETERS
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Diehl Mfg. Co., Elizabeth, N. J.
General Electric Co. Schenectady,

EBONITE. See Rubber, Hard.

ELECTROLYTE. See Chemicals, Battery.

ELECTROMAGNETS. See Coils, Finished.

ELECTRODES FOR GAS SIGNS
American Neon Light & Sign Corp., 625 Sixth Ave., New York, N. Y.
Eisler Engineering Co., 756 S. 13th, Newark, N. J.
Manhattan Elecl. Supply Co., 190 Sixth Ave., New York, N. Y.

ELECTRODYNAMOMETERS. See Instruments, Laboratory Standard.

ELEMENTS, Heating. See Units, Rods and Grids.

ENAMELING MACHINES (For Magnet Wire)
(See Also Wire Manufacturing Machines)
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia Pa.

ENGRAVING MACHINES
Portable Bench and Pedestal Outfits for Marking Metal.
Brewster Co., Wm., 30 Church, New York, N. Y.
Deckel. See Preis & Co., Inc., H. P.
Engravograph Corp., 12 Vestry, New York, N. Y.
Etchograph. See Brewster Co., Wm.
Gilbert Supply Co., Independence, Iowa.
Gorton Machine Co., Geo., Racine, Wis.
Preis & Co., Inc., H. P. Newark, N. J.

ENGRAVING, Radio Panel
Engraving to Order.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa
Eisler Engineering Co., 756 S. 13th, Newark, N. J. (Tube Base Branders).
Etch-O-Gravure See Insuline Corp. of America.
General Fabricating Co., 165 Greenwich, New York, N. Y.
Globe Mfg. Co., 101 Spokane St., Seattle, Wash.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
New England Products Co., 232 Greenwich, New York
Preis & Co., Inc., H. P., 227 Fulton, New York, N. Y.
Schwenke Machine Engraving Co., 2036 Woodward Ave., Detroit, Mich.
Verichrome Laboratories, 4614 Spring Grove Ave., Cincinnati,
Wright Radio Co., 114 Exchange, Rockland, Mass.

EYELETS
Platt Bros. & Co., Waterbury, Conn.
Waterbury Brass Goods Co., Waterbury, Conn.
Waterbury Button Co., 835 S. Main, Waterbury, Conn.

FABRIC, Radio Grill. See Cloth, Untreated.

FABRIC SHADES. See Shades, Fabric.

FAN BLADES. See Blades, Fan.

FEET, FELT. See Felt.

FELT
Advance Felt & Cutting Co., 317½ S. Jefferson, Chicago.
American Felt Co., 211 Congress, Boston, Mass.
Booth Felt Co., 460 18th, Brooklyn, N. Y.
Brawley, T. R., 279 20th, Brooklyn, N. Y.
Western Felt Wks., 4029 Ogden Ave., Chicago, Ill.

FERRULES
Chase Brass & Copper Co., Waterbury, Conn.
Clark Metal Products, 490 Hancock Ave., Bridgeport, Conn.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Massachusetts Machine Shop, Inc., Boston, Mass.
Patton-MacGuyer Co., Providence, R. I.
Platt Bros. & Co., Waterbury, Conn.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., 99 Mill, Waterbury, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., Waterbury, Conn.

FIBRE BOARD PRODUCTS (Solid and Corrugated)
Container Corp. of America, 111 W. Washington, Dept. 36, Chicago, Ill.
Mid-West Box Co., 111 W. Washington, Chicago.
Serton Mfg. Corp., 59 E. Madison, Chicago, Ill.

FIBER CANDLES. See Candles, Fixture.

FIBRE GEARS. See Gears and Pinions, Composition.
Paper. See Cloth and Paper.
Radio Panels. See Radio Molded Parts.
Shipping Containers. See Fibre Board Products.
Vulcanized. See Fibre, Vulcanized.

FIBRE, Phenol
Moisture Proof; Sheet, Rod, Tubes.
Armite. See Spaulding Fibre Co.
Bakelite-Dilecto. See Continental Fibre Co.
Campbell Fibre Co., Heather Ave., Stanton, Del.
Campbellite. See Campbell Fibre Co.
Celoron Co., Bridgeport, Pa.
Continental Fibre Co., Newark, Del.
Fibroc Insulation Co., 245 Lincoln Ave., Valparaiso, Ind.
Formica Insulation Co., 4628 Spring Grove Ave., Cincinnati, O.
Franklin Fibre Specialty Co., Wilmington, Del.
Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Phenolite See National Vulcanized Fibre Co.
Spaulding Fibre Co., Inc., Tonawanda, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

FIBRE, Vulcanized
Sheet, Rod, Tube, Horn, Fibre, Bushings, Washers, Cleats, Screw Machine Products.
Brandywine Fibre Products Co., 1402 Walnut St., Wilmington, Del.
Conite See Continental Fibre Co.
Continental Fibre Co., Newark, Del.
Delaware Hard Fibre Co., Wilmington, Del.
Diamond F. See Diamond State Fibre Co.
Diamond State Fibre Co., Bridgeport, Pa.
Egyptian. See Delaware Hard Fibre Co.
Electrosote. See Pantasote Co.
Fibro Products Co., New Bedford, Mass.
Franklin Fibre Specialty Co., Wilmington, Del.
Fyberoid. See Wilmington Fibre Specialty Co.
Independent Laboratories, 50 E. 42nd, New York, N. Y.
Iten Fibre Co., 5403 Bower Ave., Cleveland, O.
Leatheroid. See Rogers Fibre Co.
Lincoln Fibre & Specialty Co., Newport, Del.
National Vulcanized Fibre Co., Wilmington, Del.
Ohmoid See Wilmington Fibre Specialty Co.
Pantasote Co., Inc., 250 Park Ave., New York, N. Y.
Peerless. See National Vulcanized Fibre Co.
Rogers Fibre Co., 210 Lincoln, Boston, Mass.
Spaulding Fibre Co., Tonawanda, N. Y.
Standard Fibre Products Co., 36 Pleasant, Watertown, Mass.
Vul-Cot. See National Vulcanized Fibre Co.
Vulcawood. See Diamond State Fibre Co.
Wilmington Fibre Specialty Co., Wilmington, Del.

FIBRE WASHERS. See Fibre.

FIELD COILS. See Coils, Finished.

FILAMENTS, Incandescent Lamp
Conneway Elec. Laboratories 406 Jefferson St., Hoboken.
Filament Supply Co., 1317 Willow Ave., Hoboken, N. J.
Suter & Nuestl, 3709½ Lisbon Ave., Milwaukee, Wis.
Vacuum Tube Products, Siteneck Trust Bldg., Hoboken, N. J.
Volkmar & Sons, 187 Sylvan Ave., Newark, N. J. (Lead-in-Welds.)

FILES, Commutator Slotting
Ideal Commutator Dresser Co., 1006 Park, Sycamore, Ill.
Martindale Electric Co., 1264 W. Fourth, Cleveland, O.

FISH PAPER. See Cloth and Paper.

FITTINGS, Fixture. See Fixture Fittings.

FIXTURE CANDLES. See Candles, Fixture.

FIXTURE CHAIN. See Chain, Fixture.

FIXTURE, Collars. See Fixture Fittings.

FIXTURE FITTINGS

	KEY
Bowl Holders	See B
Brass Fittings	See B
Canopies	See B
Collars	See B
Crow Feet	See I
Finials (Brass, Glass and Porcelain)	See B
Hangers	See H
Hickies, Brass	See B
Hickies, Iron	See I
Hooks, Brass	See B
Hooks, Iron	See I
Iron Fittings	See I
Loops, Brass	See B
Loops, Iron	See I
Rings	See B
Shade Holders	See S
Shells	See B
Spinnings	See B
Stampings	See B
Stems	See B
Straps	See H
Studs	See I

Acme Lighting Products, Inc., 2114 Woodland Ave., Cleveland, O Straps ..... H
American Chain Co., Bridgeport, Conn. (Loops and Rings.) ..... B . . . . .
American Ring Co., Waterbury, Conn. (Candle.) . . . S . .
Appleton Electric Co., 1703 Wellington Ave., Chicago, Ill. ..... B I . . .
Arco. See American Ring Co.
Arrow Electric Division of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. ..... S . .
Artoloid. See Great Eastern Brass Wks., Inc.
Art Metal Co., 3721 Dayton, Cleveland, O. . . . . H
Banlite. See East Side Metal Spinning Co.
Banner. See Plume & Atwood Mfg. Co
Barton Brass Wks., 3627 Superior, Detroit.. B . . . . .
Belmet. See R. & L. Metal Stamping Co.
Bloch Bros., 88 Walker, New York ..... B . . . . .
Brandt Mfg. Co., 3727 Gratiot Ave., Detroit. B . . . . .
Braun, J. G., 609 S. Pauline, Chicago, Ill. (Pressed Ornaments.) ..... B I . . .
B. & L. Metal Stamping Co., 250 Moore, Brooklyn, N. Y. (Also Combination Wall Bracket Hanger.) ..... B I . . H

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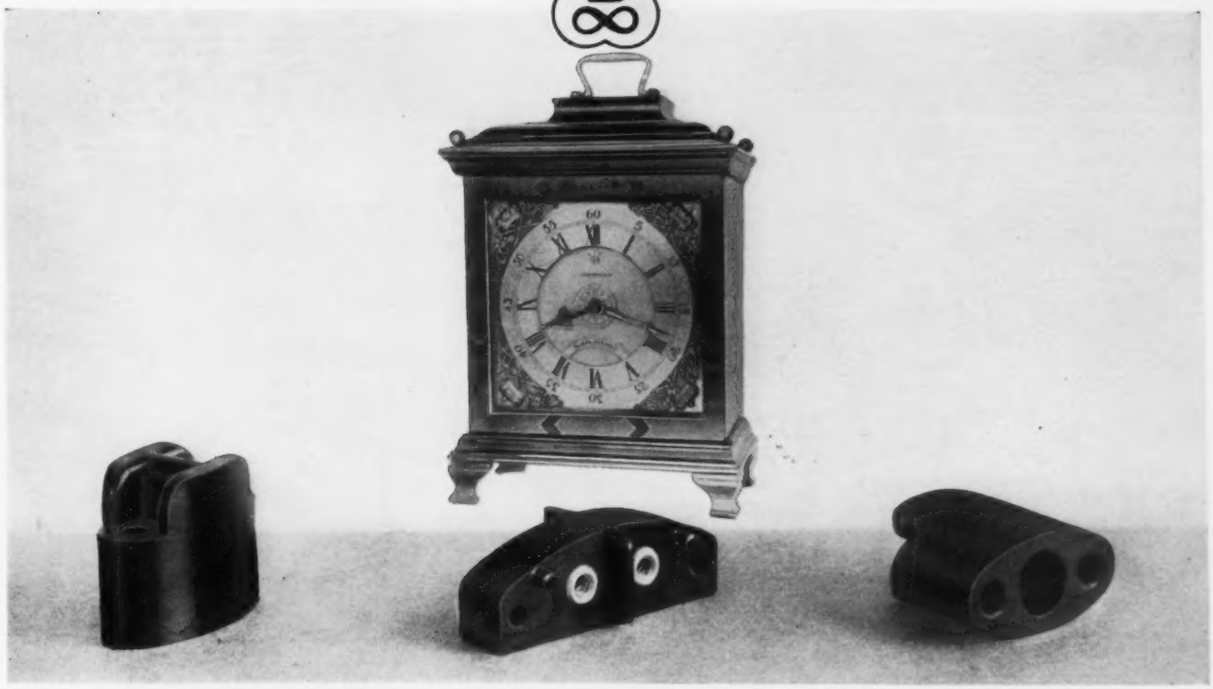
Cambridge Brass Co., Cambridge, Mass. ..... B . . . . .
Chase Brass & Copper Co., Waterbury, Conn. B . . S . .
Cleanezy. See Dunlap Co.
Colonial Stamping Co., Brill St. & Passaic Ave., Newark, N. J. ..... B . . S . .
Crescent Brass Mfg. Co., Reading, Pa. ..... B . . . . .
Crouse-Hinds, Solvay Sta., Syracuse, N. Y. ..... S H
Diamond Needle & Mfg. Co., Torrington, Conn. (Hickies.) ..... I . . .
Dunlap Co., John, Carnegie, Pa. ..... S . .
East Side Metal Spinning Co., 451 Greenwich, New York, N. Y. ..... B . . . . .
Eureka Tin Ware Mfg. Co., 135 W. 20th, New York, N. Y. ..... S . .
E-Z Up. See Plume & Atwood Mfg. Co.
Faries Mfg. Co., Decatur, Ill. ..... B I S H
Flaherty Co., M. E., 28 S. Clinton, Chicago. . . . I . . .
Fralick Co., S. R., 15 S. Clinton, Chicago. . . . I . . .
Franklin Brass Foundry Co., Reading, Pa. ..... B . . . . .
Friedley-Voshardt Co., Chicago. ..... B . . . . .
Grabler Mfg. Co., 6565 Broadway, S. E., Cleveland, O. ..... I . . .
Great Eastern Brass Wks., Inc., 182 Grand, New York, N. Y. (Spindles).
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. ..... S . .
Incandescent Supply Co., 408 West Broadway, New York, N. Y. ..... B . . . H
Isco. See Incandescent Supply Co.
Jiffy. See White Mfg. Co., J. H.
Kwikon. See Fralick Co., S. R.
Lakin. See Thomas & Betts Co.
Liberty Brass Turning Co., 88 Walker, New York, N. Y. ..... I . . .
Liberty Iron Pipe & Nipple Works, 62 Greene, New York, N. Y. ..... B I . . .
Liberty Machine Co., Wauwatosa, Wis. ..... B I . . .
Light Metal Stamping Co., 310 13th St., West New York, N. J. ..... S . .
L & K Mfg. Co., 440 Adelphi, Brooklyn, N. Y. . . . . H
L. & W. Brass Wks., 820 Orleans, Chicago, Ill. B . . . . .
Madelite. See Belson Mfg. Co.
M. S. W. Mfg. Co., 1527 Niagara Ave., Buffalo, N. Y. ..... I . . .
Metal Products Co., 210 Canal, New York. . . . B . . . . .
Metro Iron Ornament Co., 191 Christie, New York, N. Y. ..... I . . .
Metropolitan-Columbia Mfg. Co., 714 Metropolitan Ave., Brooklyn, N. Y. ..... B . . . . .
Midwest Elec. Co., 1639 Walnut, Chicago, Ill. . . I . . .
Mid-West Chandelier Co., 14th & Chestnut Sts., Kansas City, Mo. ..... B . . . . .
Michell-Vance Co., 70 Washington, Brooklyn, N. Y. ..... S . .
Monarch. See Perfeclite Co.
Murlin Mfg. Co., Philadelphia, Pa. ..... B I . . .
National Electric Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa. (Studs.) ..... I . . .
New Era Elec. Mfg. Co., 6725 Machinery Ave., N. E., Cleveland, O. ..... H
New Wrinkle. See Bryant Elec. Co.
New York Brass Turning Co., 568 Broadway, New York, N. Y. ..... B . . . . .
Nobelt. See Fralick & Co., S. R.
N. W. Cleat Receptacle Bracket, 2437 N. 29th, Philadelphia, Pa. ..... I . . .
Onli. See Perfeclite Co.
Pass & Seymour, Solvay Sta., Syracuse, N. Y. B . . S . .
Perfeclite Co., 1457 E. 40th, Cleveland. ..... S . .
Pittsburgh Valve & Fittings Co., Barberton, O. . . I . . .
Plume & Atwood Mfg. Co., Waterbury, Conn. B . . S H
Plumwood. See Plume & Atwood Mfg. Co.
Plymouth. See Yester Sons, Alfred.
Reading Brass Co., 141 Schiller, Reading, Pa. B I . . .
Ribaysen Mfg. Co., J., 952 W. Lake, Chicago, Ill. B . . . .
Rocale Mfg. Co., 200 Hudson, New York. . . . B . . . H
Sandow Tool Co., 1440 Bway, New York, N. Y. . . . S . .
Scovill Mfg. Co., Waterbury, Conn. ..... B I . . .
Simpalite. See Sprecher Mfg. Co., P. W.
Simplex. See Plume & Atwood Mfg. Co.
Springfast. See Plume & Atwood Mfg. Co.
Square-D. See Grabler Mfg. Co.
Standard Snap-Lite Corp., 504 Jackson Ave., Long Island City, N. Y. ..... S . .
Standard Metal Spinning Co., 128 Mott, New York, N. Y. ..... B . . . . .
Star. See Perfeclite Co.
Star. See Steel City Elec. Co.
Steel City Elec. Co., Pittsburgh, Pa. ..... I . . .
Steele & Johnson Mfg. Co., Waterbury, Conn. B . . S . .
Stembridge, Tenny & Brandt, 29 S. Clinton, Chicago, Ill. (White Metal.) ..... B . . . . .
Sterling Spinning & Stamping Wks., 476 Broome, New York, N. Y. ..... S . .
T. & B. See Thomas & Betts Co.
Thomas & Betts Co., 63 Vesey, New York. . . . I . . .
Uno. See Bryant Elec. Co., also Crouse-Hinds, also General Elec. Co., also Hart & Hegeman Mfg. Co., also Pass & Seymour.
United. See L. & K. Mfg. Co.
United Metal Spinning Co., 440 Adelphi, Brooklyn, N. Y. ..... B . . . . .
Vester, Sons, Alfred, 5 Mason, Providence, R. I. B . . . . .
Victor. See Plume & Atwood Mfg. Co.
Virden, Div of Gill-Virden Co., 6108 Longfellow Ave., Cleveland, O. ..... B . . . . .
Walden Tool & Metal Mfg. Co., New Haven Conn. ..... S . .
Wameco. See Waterbury Metal Wares Co.
Waterbury Co., Waterbury, Conn. ..... B . . . . .
Waterbury Metal Wares Co., Waterbury, Conn. . . . S . .
Weber Brass Co., Whitney Power Block, Cleveland, O. ..... B . . .



Ellsworth model of Sangamo Electric Clock, and samples of Bakelite Molded parts used in it. Made by Sangamo Electric Co., Springfield, Ill.

Sangamo finds Bakelite Molded parts better and decidedly more economical

ACCURATE time keeping in electrically wound clocks demands that the motor-operated winding mechanism be ready to start the instant it is called upon. Current leakage must be avoided. Insulation that is proof against deterioration in any climate is a prime essential. Sangamo found it in Bakelite Molded.

In the "Sangamo" the clock motor contact blocks are formed of Bakelite Molded, in a fourteen cavity mold, each with two metal inserts firmly embedded. These replace similar parts machined from hard rubber rod, at a saving in cost of 22 per cent.

Sangamo also found it desirable to replace a black fibre contact plug shell with one made of Bakelite Molded. This part is formed in a nine cavity mold at a saving of 28 per cent. In both instances the Bakelite Molded parts were finer in appearance and finish, and more in keeping with the character of the clocks.

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White Diamond. See White Mfg. Co., J. H.
White Mfg. Co., J. H., 111 N. 3rd, Brooklyn, N. Y. ..... B .. S ..
Wilhite Machine Wks., 1245 S. Hope, Los Angeles, Cal. ..... B .. .. ..

FLASHERS, Sign

Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.
Ajax. See Reynolds Spring Co.
A. & W. See General Outdoor Adv. Co.
Angelus. See Electric Sign Flasher Corp.
Betts, Inc., James H., 1393 Sedgwick Ave., New York. (Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.)
Betts & Betts Corp., 645 W. 43rd, New York, N. Y. (Motor Flashers.) (Thermal Flashers.) Flashing Plugs.)
California Sign Flasher Co., 220 Guttenberg, San Francisco, Cal.
Commercial Elec. Co., 1203 E. Grant, Portland, Ore.
Cramblet Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Diamond. See General Appliance Corp.
Dominic. See Kala-Flasher Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electric Signal Corp., 406 Fourth Ave., Seattle, Wash.
Electric Sign Flasher Corp., 1826 W. 9th, Los Angeles, Cal.
Figuregram. See Reynolds Electric Co.
Flash O-Lite. See Betts, Inc., James H.
Flip-Flop. See Betts, Inc., James H.
Gem Engineering Co., Hempstead, N. Y.
Gacor. See General Appliance Corp.
General Appliance Corp., 120 8th, San Francisco, Cal. (Flasher Button.)
General Controler Co., 200 E. First, Dayton, O.
Grazier Elec'l Products Co., Johnstown, Pa.
Horni Signal Mfg. Co., 516 Greenwich, New York, N. Y.
Jimbetts. See Betts, Inc., James H.
Kala-Flasher Co., 344 N. Church, Kalamazoo, Mich.
Killark. See Betts & Betts Corp.
Kontroler. See General Controler Co.
Mercury. See Betts, Inc., James H.
Opalume Sign System, Battle Creek, Mich.
Phelps Elec. Co., 29 S. Clinton, Chicago, Ill. (Motorless)
Phoenix Products Co., Phoenix, N. Y.
Presto Products Co., 64 University Place, New York, N. Y. (Sockets and Plugs.)
Reco. See Reynolds Elec. Co.
Reynolds Elec. Co., 2650 W. Congress, Chicago, Ill.
Reynolds Spring Co., Jackson, Mich.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Ryan. See Phoenix Products Co.
Skedoodle. See Phelps Elec. Co.
Sokit. See Betts, Inc., James H.
Thermo-Wynk. See Betts & Betts Corp.
Vacu. See Betts & Betts Corp.
Veebar. See Betts, Inc., James H.
Way, Eugene W., Seattle, Wash.
Wood Electric Co., C. D., 565 Broadway, New York N. Y.
Woodwin. See Wood Elec. Co., C. D.
Wynk-A-Lyte. See Betts & Betts Corp.

FLASHLIGHT LENSES. See Lenses.
FLEXIBLE ARMS. See Tubing, Flexible Metallic.
FLEXIBLE LEADS, Commutator Brush. See Brushes, Commutator.

FLEXIBLE SHAFT MACHINES

(For shafting. See Tubing, Flexible Metallic.)
Strand & Co., N. A., 5001 N. Lincoln, Chicago, Ill.

FORGINGS, Non-Ferrous

Scovill Mfg. Co., Waterbury, Conn.

FORMS, Coil Winding

Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, O.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Master. See Armature Coil Equipment Co.

FORMS, Wire

Forms and Frames for Shade Holders and Shades: Bending, Welding, Forming.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
Arrow Wire Frame Corp., 344 E. 23rd, New York, N. Y.
Blake & Johnson Co., Waterbury, Conn.
Central Wire Frame Co., 154 E. 23rd, New York, N. Y. (Complete with socket, cord and plug.)
Chelsea Wire Wks., 675 Hudson, New York, N. Y.
Clark Metal Products Inc., 490 Hancock Ave., Bridgeport Conn.
Electro Weld Co., 70 Munroe, Lynn, Mass.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hunter Pressed Steel Co., Lansdale, Pa.
Jeschke Wire Specialty Wks., Crawfordsville, Ind.
Krischer's Mfg. Co., 255 Calyer, Brooklyn, N. Y.
Manhattan Wire Products Co., 398 First Ave., New York.
Murray Hill Wire Frame Co., 314 E. 32nd, New York, N. Y.
Roebling's Sons Co., John A., Trenton, N. J.
Steinen & Co., 297 Washington, Newark, N. J.
Watral & Sons, 133 E. 16th, New York, N. Y.
Young Industries, Inc., L. A., Detroit, Mich.

FRAMES, Wire. See Forms, Wire.
FRICTION TAPE. See Tape, Rubber and Friction.
FRINGE, Chandelier. See Crystals, Chandelier.

FUSE CLIPS

Sherman Mfg. Co., H. B., Battle Creek, Mich.
Waterbury Brass Goods Co., Waterbury, Conn.

FUSE TESTERS. See Testers, Fuse and Circuit.

FUSES AND FUSE WIRE

KEY

Cartridge ..... See C
Plug ..... See P
Non-Refillable ..... See N
Refillable ..... See R
Open Link ..... See O
Fuse Wire ..... See O

Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J. ..... P .. .. ..
Arkless. See Economy Fuse Mfg. Co.
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. ..... P N .. ..
Automatic Elec. Iron & Fuse Co., 215 S. American, Philadelphia, Pa. ..... P .. .. ..
Blue Ribbon. See Royal Elec. Co.
Buss. See Bussman Mfg. Co.
Bussmann Mfg. Co., University & Jefferson Ave., St. Louis ..... C P N R O
Chase-Shawmut Co., Newburyport, Mass. .. C P N R O
Clearite. See Economy Fuse & Mfg. Co.
Clear-Top. See Trico Fuse Mfg. Co.
Colortop. See Trico Fuse Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. (Automobile) ..... C .. N R ..
Cote Bros. Mfg. Co., 182 W. Lake, Chicago C P .. R ..
Crystal. See Royal Elec. Co.
Daum Fuse & Elec. Mfg. Co., 1157 Hodgkins, Pittsburgh ..... C .. .. R ..
D. & W. See Graybar Electric Co.
Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Ill. ..... C P N R ..

Eco. See Economy Fuse & Mfg. Co.
Electric Fuseguard Co., Charlottesville, Va.. C P N R ..
Elliott Electric Co., Shreveport, La. ....
Gem. See Chicago-Jefferson Fuse & Electric
General Elec. Co., Section W-233 Merchandise Dept., Bridgeport, Conn. ..... C P N R ..
Graybar Electric Co., Graybar Bldg., Lexington Ave. and 43rd St., New York, N. Y. C .. ..
Great Western Fuse Co., 415 Lexington Ave., New York, N. Y. ..... C .. .. R ..
H. & H. See Hart & Hegeman.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. ..... P .. R .. O
Hudson Wire Co., Ossining, N. Y. .... O
Kantark. See Trico Fuse Mfg. Co.
Kirkman Engrg. Co., 1 Dominick St., New York, N. Y. ..... C P N .. O
Littelfuse Laboratories, 1772 Wilson Ave., Chicago, Ill. (Low Capacity, Glass Enclosed, .025 to 2 Amp.) ....
Monarch Fuse Co., Jamestown, N. Y. ..... C .. N R ..
National. See Economy Fuse & Mfg. Co.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Pierce Renewable Fuses, Inc., 752 Main, Buffalo, N. Y. ..... C P .. R ..
Platt Bros. & Co., Waterbury, Conn. .... O
Powell, F. W., 119 W. Ohio, Pittsburgh .. P .. R ..
Ree-Nu-It Elec. Co., New Bedford, Mass.. C P .. R ..
Rochester Re-Fill Fuse Co., 402 Cottage, Rochester, N. Y. ..... C .. .. R ..
Royal Elec. Co., Chelsea Station, Boston.. .. P N .. ..
Shawmut. See Chase-Shawmut Co.
Simplicity. See Cote Bros. Mfg. Co.
Six-in-One. See Industrial Engrg. Co.
Star Fuse Co., 235 Canal, New York, N. Y. C P .. R ..
Trico Fuse Mfg. Co., 1001 McKinley Ave., Milwaukee ..... C P N R ..
Union. See Chicago-Jefferson Fuse & Electric

GALVANIZING

Battle & Bros., Joseph P., Gaul and Lotterly Sts., Philadelphia, Pa.

GALVANOMETERS. See Instruments, Laboratory Standard.

GAS INERT

Helium Co., Louisville, Ky.
Palestine Industrial Co., 111 Fifth Ave., New York, N. Y.

GASKETS, Rubber

Gutta Percha & Rubber Mfg. Co., 15 Park Row, New York.
Canfield Rubber Co., Bridgeport, Conn.

GAUZE BRUSHES, Wire. See Brushes, Commutator.
GEARS, Fibre. See Gears and Pinions, Composition.

GEARS (Speed Changing Units)

Cleveland Worm & Gear Co., Cleveland, Ohio.
Cullman Wheel Co., 1346 Altgild, Chicago, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Falk Corp., Milwaukee, Wis.
Foote Bros. Gear & Machine Co., 215 N. Curtis, Chicago, Ill.
Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Jones Pty. & Machine Co., W. A., Chicago, Ill.
Lipe, W. C., Syracuse, N. Y.
Nuttall Wks., of Westinghouse Elec. & Mfg. Co., McCandless Ave. & Harrison St., Pittsburgh, Pa.
Palmer-Bee Co., Detroit, Mich.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Philadelphia Gear Works, Richmond and Tioga Sts., Philadelphia, Pa.
Smith, Winfield H., Springville, N. Y.

GEARS, Worm

Albaugh-Dover Mfg. Co., Chicago, Ill.
Cleveland Worm & Gear Co., Cleveland, Ohio.
Colburn Gear & Mfg. Co. (Norfolk Downs), Quincy, Mass.
Philadelphia Gear Works, Richmond and Tioga Sts., Philadelphia, Pa.

GEARS AND PINIONS, Composition

Celoron Co., Bridgeport, Pa.
Delaware Hard Fibre Co., Wilmington, Delaware.
Diamond State Fibre Co., Bridgeport, Pa.
Fabroil. See General Elec. Co.
Foote Bros. Gear & Machine Co., 215 N. Curtis, Chicago, Franklin Fibre Specialty Co., Wilmington, Del.
General Electric Co., Schenectady, N. Y.
Medart Co., St. Louis, Mo.
Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Stahl Gear Co., 1390 E. 40th, Cleveland, Ohio.
Stranahan Gear Co., Philadelphia, Pa.
Textoil. See General Electric Co.
Textolite. See General Electric Co.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GEARS AND PINIONS, Iron and Steel

Earle Gear & Machine Co., Wayne Junction, Philadelphia.
Falk Corp., Milwaukee, Wis.
Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Medart Co., St. Louis, Mo.
Meisel Bros. Mfg. Co., 944 Dorchester Ave., Boston, Mass.
Perkins Machine & Gear Co., 129 Circuit Ave., Springfield, Mass.
Permag. See Perkins Machine.
Tool Steel Gear & Pinion Co., Cincinnati, Ohio.

GEARS AND PINIONS, Rawhide

Chicago Rawhide Mfg. Co., 1313 Elston Ave., Chicago, Ill.
Gerdes & Co., 50 Church, New York, N. Y.
Syracuse Rawhide Mfg. Co., Syracuse, N. Y.
Western Rawhide & Belting Co., Milwaukee, Wis.

GENERATORS, Electroplating. See Plating Generators.
GLASS BULBS. See Bulbs, Glass.
GLASS CANDLES. See Candles, Fixture.
GLASS LETTERS. See Letters, Sign.

GLASS, for Electrical Purposes

Corning Glass Wks., Corning, N. Y.
Pyrex. See Corning Glass Wks.

GLASSWARE

Alba. See Macbeth-Evans Glass Co.
Amazon. See Gleason-Tiebout Glass Co.
Amelites. See Consolidated Lamp & Glass Co.
Apollo. See Gillinder Bros., Inc.
Ardmore. See Jeannette Shade & Novelty Co.
Aurene. See Corning Glass Co.
Aurora. See Consolidated Lamp & Glass Co.
Bayley Sons, 100 Vanderveer, Brooklyn, N. Y.
Beaumont Co., Morgantown, W. Va.
Bellova. See McFaddin & Co., H. G.
Blanco. See Gleason-Tiebout Glass Co.
Beryllite. See Plaut & Co., L.
Bostock, Rhodes & Co., 11 N. Moore, New York, N. Y.
Cavnia. See Gleason-Tiebout Glass Co.
Carara. See Gleason-Tiebout Glass Co.

Celestialite. See Gleason-Tiebout Glass Co.
Chester & Sons Co., J., 45 Varick Ave., Brooklyn, N. Y.
Clearcut. See Ivanhoe Division of Miller Co.
Colcite. See Corning Glass Co.
Consolidated Lamp & Glass Co., Coraopolis, Pa.
Cora. See Consolidated Lamp & Glass Co.
Cora-Lites. See Consolidated Lamp & Glass Co.
Corning Glass Co., Corning, N. Y.
Cremax. See Macbeth-Evans Glass Co.
Crystal. See Phoenix Glass Co.
Daylite. See Wells Glass Co.
Decora. See Macbeth-Evans Glass Co.
Delica-White. See Kopp Glass, Inc.
Druid. See Ivanhoe Division of Miller Co.
Eagle Mfg. Co., Wellsburg, W. Va.
Emeralite. See McFaddin, H. G.
Equalite. See Bayley & Sons.
Erskine Glass & Mfg. Co., Wellsburg, W. Va.
Federal Light & Lens Corp., Star City, W. Va.
Florentine. See Gleason-Tiebout Glass Co.
Genco. See Ivanhoe Division of Miller Co.
Gillinder Bros., Inc., Port Jervis, N. Y.
Gillinder & Sons, Inc., Philadelphia, Pa.
Gleason-Tiebout Glass Co., 99 Commercial, Brooklyn, N. Y.
Gletieco. See Gleason-Tiebout Glass Co.
Havana. See Kopp Glass, Inc.
Hocking Glass Co., Lancaster, O.
Holophane Co., 342 Madison Ave., New York, N. Y.
Imperial Glass Co., Bellaire, O.
Inland Glass Works, Chicago, Ill.
Ivanhoe Division of Miller Co., Cleveland, Ohio.
Ivory. See Phoenix Glass Co.
Ivre. See Ivanhoe Division of Miller Co.
Jeannette Shade & Novelty Co., Jeannette, Pa.
Jefferson Glass Co., Follansbee, W. Va.
Kauffeld Glass & Ceramic Co., Star City, W. Va.
King-Tutankhamen. See Macbeth-Evans Glass Co.
Kopp Glass, Inc., Swissvale, Pa.
Lumina. See Hocking Glass Co.
MacBeth-Evans Glass Co., Dept. G, Eastern Division, Charleroi, Pa.
Magnolia. See Phoenix Glass Co.
McFaddin & Co., H. G., 38 Warren, New York, N. Y.
Mellilite. See Gillinder & Sons, Inc.
Micro. See Gillinder & Sons, Inc.
Miller Co., Meriden, Conn.
Monax. See Macbeth-Evans Glass Co.
Moonstone. See Jefferson Glass Co.
N. B. G. See Gillinder & Sons, Inc.
N. U. Glass. See Gillinder & Sons, Inc.
Nebulite. See Gillinder & Sons, Inc.
Nemalite. See Gillinder & Sons, Inc.
Nitro-Glas. See Jefferson Glass Co.
Nuart. See Imperial Glass Co.
Nulite. See Consolidated Lamp & Glass Co.
Nutralux. See Kopp Glass, Inc.
Opalux. See Gleason-Tiebout Glass Co.
Opola. See Inland Glass Co.
Pastelle. See Consolidated Lamp & Glass Co.
Pearlitone. See Inland Glass Co.
Persian. See Gillinder & Sons, Inc.
Phoenix Glass Co., 230 Fifth Ave., New York, N. Y.
Pilabrasgo. See Kopp Glass, Inc.
Pittsburgh Cut Glass Co., Monaca, Pa.
Plaut & Co., L., 432 E. 23rd, New York, N. Y.
Poly-Case. See Gleason-Tiebout Glass Co.
Prestopal. See Gleason-Tiebout Glass Co.
Quezal Glass Mfg. Co., Fresh Pond Rd. and Metropolitan Ave., Brooklyn, N. Y.
Radiant. See Phoenix Glass Co.
Regent. See Ivanhoe Division of Miller Co.
Rezelle. See Ivanhoe Division of Miller Co.
Rosedora. See Consolidated Lamp & Glass Co.
Shade-O-Tone. See Consolidated Lamp & Glass Co.
Snow-White. See Inland Glass Works.
Soloman & Son, Inc., L., 199 Wooster, New York, N. Y.
Star Glass Co., Star City, W. Va.
Sudan. See Ivanhoe Division of Miller Co.
Thebian. See Macbeth-Evans Glass Co.
Translux. See Kopp Glass, Inc.
Trojan. See Ivanhoe Div. of Miller Co.
United Novelty Glass Mfg. Co., 121 Prince, New York, N. Y.
Utopia. See Kopp Glass, Inc.
Velaria. See Ivanhoe Division of Miller Co.
Vineland Flint Glass Wks., Vineland, N. J.
Wells Glass Co., Kokomo, Ind.
Williamsburg Flint Glass Co., 290 Broadway, New York.
Yural. See Ivanhoe Division of Miller Co.
Zanesville Mould Co., Zanesville, O.

GONGS, Unmounted Shells

Bevin Bros. Mfg. Co., East Hampton, Conn.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
East Hampton Bell Co., East Hampton, Conn.
Gong Bell Mfg. Co., East Hampton, Conn.
Hill Brass Co., M. N., East Hampton, Conn.
Liberty Bell Mfg. Co., Minerva, O.
Reiter, G. C., Canton, O.

GRAPHITE BEARINGS. See Bearings, Oil-less.
GRID LEAKS. See Radio Circuit Components.
GRIDS, Resistance. See Units, Rods and Grids.
GRILL CLOTH. See Cloth, Untreated.
GROMMETS. See Eyelets.
GROUND LOCATORS. See Instruments, Portable and Switchboard; also Testers, Coil.
GROWLERS, Armature. See Testers, Coil.

HANDLES, Wood; For Switches or Sad Irons

Allen, Chas. E., Pequabuck, Conn.
American Enamel Co., 20 Neville, Providence, R. I.
Bogert & Hopper, 225 Varick, New York, N. Y.
Estes & Son, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Fitchburg Enamel Co., Fitchburg, Mass.
Flanders Hardware Co., North Weare, N. H.
Fuller, J. J. Westfield, Mass.
Narragansett Mach. Co., Pawtucket, R. I.
National Wood Process, New Bedford, Mass.
Novelty Turning Co., Norway, Me.
Ober Mfg. Co., Chagrin Falls, O.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, O.
Piqua Handle & Mfg. Co., Piqua, Ohio.
Royal Enamel Co., Fitchburg, Mass.
Schutz Bros., 152 Chambers, New York, N. Y.
Stiles & Co., H. A., 174 Portland, Boston, Mass.
Stratton Mfg. Co., Stratton, Maine.
Sun Enamel Wks., Leominster, Mass.

HOLDERS, Brush. See Brushes, Commutator.
HOT WIRE METERS. See Instruments, Portable and Switchboard.
IMPREGNATING COMPOUNDS. See Wax and Compounds
IMPREGNATING, VACUUM. See Ovens, Industrial.
INCANDESCENT LAMP BULBS (Unfinished). See Bulbs, Glass.
INCANDESCENT LAMP FILAMENTS. See Filaments, Incandescent Lamp.

INDICATORS, Operation

Operation and Cost Indicators for Manager's Office.
Bristol Co., Waterbury, Conn. (Elapsed Time Recorder.)
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Production Meter Co., 1315 S. Wabash Ave., Chicago, Ill.

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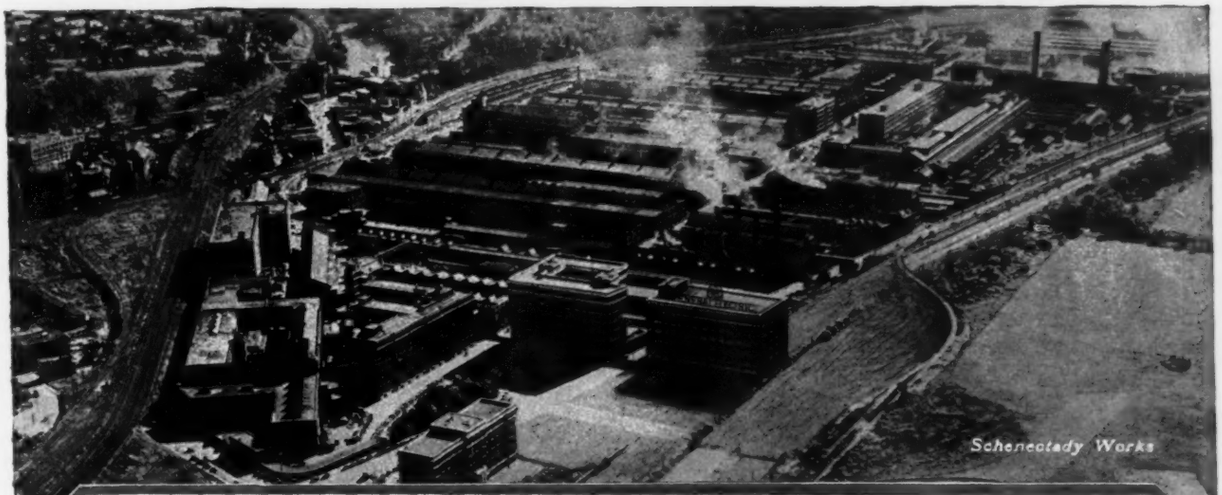

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INDUCTION COILS. See Coils, Finished.
INSTRUMENT, Jewels. See Jewels.
INSTRUMENTS, Laboratory Standard. See Instruments, Laboratory Standard.
INSTRUMENTS, Portable Testing. See Instruments, Portable and Switchboard; also Instruments, Pocket.

INSTRUMENTS, Laboratory Standard

Beck Bros., 3640 N. Second, Philadelphia, Pa.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Burt, R. C., 327 Michigan Ave., Pasadena, Cal. (Oscilloscopes.)
Cambridge Instrument Co., Ossining, N. Y.
Chicago Apparatus Co., 1735 N. Ashland Ave., Chicago, Ill
Eppley Laboratory, Newport, R. I. (Standard Cells.)
Fahy. See Rubicon Co.
General Electric Co., Schenectady, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa
Hickok Elec'l Instrument Co., 10514 Dupont, Cleveland, O
Jagabi. See Biddle, James G.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill
Kasson. See Rawson Elec'l. Instrument Co.
Kelvin. See Leeds & Northrup Co.
Kohlrausch. See Leeds & Northrup Co.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa
Milvay. See Chicago Apparatus Co.
Osiso. See Westinghouse Electric & Mfg. Co.
Radio Elec'l Wks., 50 W. 22nd, New York, N. Y.
Rawson Elec'l Instrument Co., Cambridge, Mass.
Roller-Smith Co., 239 Broadway, New York, N. Y
Rubicon Co., 29 N. Sixth, Philadelphia Pa. (Wheatstone Bridges, Galvanometers, Inductance Condensers, Potentiometers, Resistance Boxes, Permeameters.)
Simplex. See Leeds & Northrup Co.
Strobatchy. See Radio Elec'l Wks.
Thompson-Levering Co., 351 N. 57th St., Philadelphia, Pa
Vawter. See Thompson-Levering Co.
Unipivot. See Rawson Elec'l Inst Co.
Vreeland Apparatus Co., 140 Cedar, New York, N. Y (Sine Wave Oscillators.)
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave. Newark, N. J.

INSTRUMENTS, Pocket

Advance. See Eldredge Elec'l Corp.
Adbro Mfg. Co., 927 French, Pittsburgh, Pa.
Eclipse. See Eldredge Elec'l Corp.
Eldredge Elec'l Corp., 3 P. O. Sq., Springfield, Mass.
Ideal Instrument Co., Penacook, N. H.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Lundquist Tool & Mfg. Co., Worcester, Mass.
Milavolt. See Adbro Mfg. Co.
Readrite Meter Works, 7 College Ave., Bluffton, Ohio.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Shire Elec. Products Co., Marquette Bldg., Detroit, Mich
Sholder-Excel Mfg. Co., Clyde, Ohio.
Square D Company, Detroit, Mich.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio.
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave., Newark, N. J
Wigginton. See Square D Company.
Yankee. See Lundquist Tool Mfg. Co.

INSTRUMENTS, Portable and Switchboard

This heading includes all standard, portable and switchboard types, measuring and testing instruments—ammeters, voltmeters, wattmeters, ohmmeters, cable testers and fault-finders.

See Also Instruments, Pocket; Also Instruments, Laboratory Standard.

Beck Bros., 421 Sedgley Ave., Philadelphia, Pa.
Beede Instrument Co., Penacook, N. H.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Brown Instrument Co., Wayne and Windrim Sts., Philadelphia, Pa.
Cambridge Instrument Co., Ossining, N. Y.
Dongan Electric Mfg. Co., 2985 Franklin, Detroit, Mich.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Electric Mfg. Co., 966 Mission, San Francisco, Cal.
Esterline-Angus Co., Speedway, Indianapolis, Ind.
Fidelity Electric Co., Lancaster, Pa.
Fisher Cable Test Sets. See Leeds & Northrup.
Fore Elecl. Mfg. Co., 5255 Wabada Ave., St. Louis, Mo
Freyn Engrg. Co., 310 S. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa.
Ground-Olmer. See Sticht & Co.
Handy. See Weinberg & Co.
Hickok Elecl. Inst. Co., 10514 Dupont, Cleveland, O.
Hoyt Elecl. Inst. Wks., 857 Boylston, Boston, Mass.
I T L. See Illinois Testing Laboratories.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa
Master. See Jewell Elecl. Instrument Co.
M. D. C. See Metropolitan Devices Corp.
Megger Testing Sets. See Biddle.
Metropolitan Devices Corp., 1250 Atlantic Ave., Brooklyn
Multi-Volt Trouble Finder. See Welford, Jr., Geo. W.
Nagel Elecl. Co., W. G., 23 St. Clair, Toledo, Ohio.
Norton Elecl. Inst. Co., 81 Hilliard, Manchester, Conn.
Paneltest Meters. See Beede Instrument Co.
Peerless Meters. See Thompson-Levering Co.
Pier Equipment Mfg. Co., Benton Harbor, Mich.
Pin-Jack. See Weston Elec'l Instrument Co.
Price Hollister Co., Rockford, Ill.
Radio Electric Works, 150 West 22nd St., New York, N. Y.
Rawson Elecl. Inst. Co., Cambridge, Mass.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Sangamo Elec. Co., Springfield, Ill.
Shortfinder. See Eisemann Shortfinder Co.
Standee. See Sticht Co., H. H.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio.
Sticht & Co., H. H., 13 Park Row, New York, N. Y.
Tanner Engrg. Co., Rawson St. and Nelson Ave., Long Island City, N. Y.
Test-A Rat See Beede Instrument Co.
Thompson-Levering Co., 351 N. 57th, Philadelphia, Pa.
Thomson. See General Electric Co.
Triplex Meters. See Roller-Smith Co.
3 in 1. See Sticht & Co., H. H.
Two-in-One. See Stitcht Co., Herman H.
United States Gauge Co., 44 Beaver, New York, N. Y.
Utility See Esterline-Angus Co
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave., Newark, N. J.

INSULATION (Insulating) (Insulators)
Beads. See Beads, Insulating.
Canopy. See Insulators, Canopy.
Cloth. See Cloth & Paper.
Composition. See Molded Insulation.
Compound. See Wax and Comp.
Fibre. See Fibre.
Lava. See Cores, Resistance Coil.
Marble. See Slate
Mica. See Mica.
Molded. See Molded Insulation.
Paint. See Paint and Varnish.
Paper. See Cloth and Paper Insulating.
Phenolic. See Fibre, Phenol. Also Molded Insulation

GLASS SPECIALTIES
COLORED
SIGNAL LENSES

Investigate Our Facilities
QUALITY—SERVICES—PRICES

ROCHESTER GLASS PRODUCTS COMPANY
29 N. Water St., Rochester, N. Y.

Porcelain. See Porcelain.
Rod. See Rubber, Hard.
Rubber. See Rubber, Hard.
Sealing Wax. See Wax and Compounds.
Slate. See Slate.
Soapstone. See Soapstone.
Tubing. See Tubing, Varnished Fabrics.
Varnish. See Paint and Varnish.
Wax. See Wax and Compounds.

INSULATING MACHINES, WIRE. See Wire Manufacturing Machines.
INSULATING TUBING. See Tubing, Varnished Fabric; also Tubing, Rubber.

INSULATION CUTTERS

Artos Engrg. Co., Milwaukee, Wis.

INSULATION MIXERS

Baker Perkins Co., Saginaw, Mich.

INSULATION SHEARS. See Shears, Insulation.
INSULATION STRAINING MACHINES. See Wire Manufacturing Machines.

INSULATION TESTERS. See Instruments, Laboratory Standard.

INSULATORS, Canopy

Diamond State Fibre Co., Bridgeport, Pa.
Franklin Fibre Specialty Co., Wilmington, Del.
General Electric Co., Schenectady, N. Y.
Knu See Stanley, Arthur F.
Macallen Co., Boston 27, Mass.
Stanley, Arthur F. 150 Varick, New York, N. Y.
Wilmington Fibre Specialty Co., Wilmington, Del.

IRON CASTINGS. See Castings, Gray Iron.
IRONS, Soldering. See Soldering Irons.
JACKS, Armature. See Lifts, Armature.
JACKS, Radio. See Radio Receiver Parts.

JARS, Battery, Glass

For Composition Jars. See Molded Insulation; also Rubber.
Corning Glass Co., Corning, N. Y.
Cumberland Glass Mfg. Co., Bridgeton, N. J.
Gaynor Glass Works, Salem, N. J.
Gillinder & Sons, Inc., Philadelphia, Pa.
Hazel Atlas Glass Co., Wheeling, W. Va.
Macbeth Evans Glass Co., Dept. G, Eastern Division, Charlerol, Pa.
Rodefer Glass Co., Bellaire, O.
Sneath Glass Co., Hartford City, Ind.
United States Glass Co., 9th & Bingham, Pittsburgh, Pa.

JEWELS, Instrument Bearing

Bird, Richard H., Waltham, Mass.
Deknatel & Sons, J. A., Queens Village, N. Y.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Fisher, Thomas E., Penacook N. H.
Gatti, Inc., Aurele M., Liberty St. & Fairmount Ave., Trenton, N. J.
Moser Jewel Co., Perth Amboy, N. J.
Mildrum Jewel Co., East Berlin, Conn.
Sapphire Products Co., 51 Chambers, New York, N. Y.
Wennstrom's Sons Co., John, Suffern, N. Y.
Worley Jewel Co., John, Waltham, Mass.
Universal. See Oefinger, J. L.

JOINTS, Fixture Insulating

Appleton Elec. Co., 1703 Wellington Ave., Chicago, Ill.
Macallen Co., Boston 27, Mass.
Sandow Tool Co., 1440 Broadway, New York, N. Y.
Sprecher Mfg. Co., P. W., 3220 North Ave., Milwaukee.
White Co., O. C., 15 Hermon, Worcester, Mass.
Wittenberg Bros., 60 Shipman, Newark, N. J.

LABORATORY (Laboratories.)
Ovens. See Ovens, Industrial & Laboratory.
Rheostats. See Rheostats.
Testing. See Testing.

LABORATORY STANDARD INSTRUMENTS. See Instruments, Laboratory Standard.
LACQUER, ARMATURE. See Paint, Varnish and Lacquer. Metal. See Paint, Varnish and Lacquer.
LAMINATIONS. See Discs, Armature.
LAMP BASES. See Bases, Reading Lamp.
LAMP BULBS (Unfinished). See Bulbs, Glass.
LAMP FILAMENTS. See Filaments, Incandescent Lamp.
LAMP LEAD-IN WELDS. See Filaments, Incandescent Lamp.
LAMP TESTING PHOTOMETERS. See Photometers, Lamp Testing.

LATHES

(Special for use in Motor Repairing and Motor Mfg.—Test Bench Lathes).
Ajax Electric Co., Kalamazoo, Michigan.
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Cincinnati Lathe & Tool Co., 3207 Disney (Oakley) Cincinnati, Ohio.
Hobart Bros. Company, Troy, Ohio. (Test Bench).
Weidenhoff, Joseph, 4352 W. Roosevelt Rd., Chicago, Ill.

LAVA. See Cores, Resistance Coil.
LEAD-IN WELDS, Lamp. See Filaments, Incandescent Lamp.
LEADS, FLEXIBLE (Commutator Brush). See Brushes, Commutator.

LENSES

Sign Letter, Flashlight, Projector and Reflector Lenses. Also glass caps, jewels and bezels for all electrical devices See also Jewels, Instrument Bearing.
Bausch & Lomb Optical Co., 635 St. Paul, Rochester, N. Y. (Condensing and Projection Lenses.)
B. B. T. Corp. of America, Atlantic Bldg., Philadelphia, Pa.
Corning Glass Wks, Corning, N. Y. (Flashlight and Signal.)
Deknatel & Sons, J. A., Queens Village, N. Y.
Gilligan Glass Products Co., New Philadelphia, Ohio.
Goerz American Optical Co., C. P., 317 E. 34th, New York.
Jefferson Glass Co., Follansbee, W. Va. (Sign and Flashlight.)
Kliegl Bros. Universal Stage Ltg. Co., 321 W. 50th, New York, N. Y. (Condensing and Projector.)
Macbeth Evans Glass Co., Dept. G, Eastern Division, Charlerol, Pa. (Flashlight.)
North Light Corp., 50 W. 15th, New York, N. Y.
Popper & Sons, Leo, 147 Franklin, New York, N. Y.
Pyle National Co., 1334 N. Kostner Ave., Chicago, Ill.
Rochester Glass Products Co., 29 N. Water, Rochester, N. Y.
Rodefer Glass Co., Bellaire, O. (Flashlight.)
Sneath Glass Co., Hartford City, Ind. (Sign.)
Stromberg-Carlson Telephone Mfg. Co., 1050 University Ave., Rochester, N. Y.

LETTERS, Sign

Glass. Metal.
Adsign Corp, 113 W. 63rd, New York, N. Y.
Chain Products Co., 3924 Cooper Ave., Cleveland, O. (Brass and White Metal.)
Chicago Miniature Lamp Co., 652 W. Lake, Chicago, Ill. (Raised Letters for Signs.)
Eradium. See Pioneer Corporation.
Federal Elec. Co., 8700 S. State, Chicago, Ill. (Metal.)
Grammes & Sons, Inc., L. F., Allentown, Pa.
Heralite. See Pressed Prism Plate Glass Co.
Kolux Glass Sales Co., Kokomo, Ind.
Lu-Mi-Nus Signs Inc., 2736 Wentworth Ave., Chicago, Ill.
Manhattan Elecl. Supply Co., 190 Sixth Ave., New York, N. Y. (For Gas Signs.)
Opalite Corp., 201 E. Ohio, Chicago, Ill.
Pioneer Corporation, 8308 Yale Ave., Chicago. (Luminous.)
Pressed Prism Plate Glass Co., Chicago, Ill. (Glass.)

LIFTS, Armature

Lifts, Hoists, Jacks, Trucks, Buggies, Floor Cranes.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Duff Mfg. Co., Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Ridion Company, Frank, Boston, Mass.

LININGS, Socket

Remington Mfg. Co., 937 Barnum Ave., Bridgeport, Conn.

LOCK WASHERS. See Washers, Lock.
LOOP WINDERS & SPREADERS. See Winding Machines, Armature & Field Coil.
LOUD SPEAKER DIAPHRAGMS MATERIAL. See Cloth, Untreated; also Parchment Paper.

LOUD SPEAKERS

Manufacturers Units and Electric Pick-ups for Portable and Built-in Types.
American Reproducer Corp., 55 W. 42nd, New York, N. Y.
A. R. C. See American Reproducer Corp.
Amplion. See Woolf, J. W. & W. L.
Balsa Wood Reproducer Corp., 331 Madison Ave., New York.
Brielle. See Penn Mfg. Co.
Brooklyn Metal Stamping Corp., 720 Atlantic Ave., Brooklyn, N. Y. (Electric Pick-up.)
Cannonball. See Cannon & Miller Co.
Cannon & Miller Co., Springwater, N. Y.
Chelten Electric Co., 4859 Stenton Ave., Philadelphia, Pa.
Conamic See Operadio Mfg. Co.
Decatur Mfg. Co., 45 Harman St., Brooklyn, N. Y.
Dreher & Son, Chas., 157 Spring, New York, N. Y.
Dynac. See Electrical Products Mfg. Co.
Electrical Products Mfg. Co., Providence, R. I.
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill. (Units.)
Empire United Hat Block Co., 312 E. 12nd, New York.
Engineers Service Co., 25 Church, New York, N. Y. (Kit.)
Enseo. See Engineers Service Co.
Fenco Cone Co., 57 Murray, New York, N. Y. (Kit.)
Fergus Co., 235 Elizabeth Ave., Newark, N. J.
Globe Technolian Corp., Reading, Mass.
G R. P. See Penn Mfg. Co.
Grutal Speaker Co., 609 E. Walnut, Des Moines, Iowa.
Jensen Radio Mfg. Co., 338 N. Kedzie Ave., Chicago, Ill.
Kersten Radio Equipment, Inc., 1415 Fillford, Kalamazoo, Mich.
Lata Balsa. See Balsa Wood Reproducer Corp.
Magnavox Co., 4250 Horton, Oakland, Cal. Also Units.
Markone Radio Mfg. Co., 303 Devoe, Brooklyn, N. Y. (Horn.)
Miles Mfg. Co., 191 Joralemon, Brooklyn, N. Y.
Minuet. See Thompson Radio Co.
Molded Wood Products, 219 W. Chicago Ave., Chicago, Ill.
Mozart-Radioceive. See Fergus Co.
Newcombe-Hawley, Inc., St. Charles, Ill.
Newton Elec'l Mfg. Co., Newton, Mass.
O'Neil Mfg. Corp., West New York, N. J.
Operadio Mfg. Co., St. Charles, Ill.
Peerless. See United Radio Corp.
Penn Mfg. Co., G. R., 231 Mercer, New York, N. Y.
Philadelphia Storage Battery Co., Ontario & C Sts., Philadelphia, Pa.
Philco. See Philadelphia Storage Battery Co.
Platter Cabinet Co. North Vernon, Ind.
Powerola. See Temple Corp.
Puropower. See Platter Cabinet Co.
Quam Radio Corp., 9703 Cottage Grove Ave., Chicago, Ill.
Racon Elec. Co., 18 Washington Place. New York, N. Y. (Horn only.)
Radio Cabinet Co., 2118 Gale, Indianapolis, Ind.
Red Lion Cabinet Co., Red Lion, Pa.
Stromberg-Carlson Tel. Mfg. Co., 1060 University Ave., Rochester, N. Y.
Sucboda Co., Maritime Bldg., Seattle, Wash.
Temple Corp., 5253 W. 65th, Chicago, Ill.
Thompson Radio Co., 25 Church, New York, N. Y.
Ultratone Mfg. Co., 1046 W. Van Buren, Chicago, Ill.
United Radio Corp., 25 Leighton Ave., Rochester, N. Y.
Universal High Power Telephone Co., Carleton Ave. and Eddy, Seattle, Wash.
Utah Radio Products Co., 1615 S. Michigan Ave., Chicago, Ill. (Also Piano Unit.)
Victor Radio Corp., 4321 N. Western Ave., Chicago, Ill.
Wondrphone. See Universal High-Power Telephone Co.
Woolf J W & W L., 227 Fulton, New York, N. Y.
Wright-De Coster, Inc., St. Paul, Minn.
Zisch Engineering Corp., Newark, N. J.

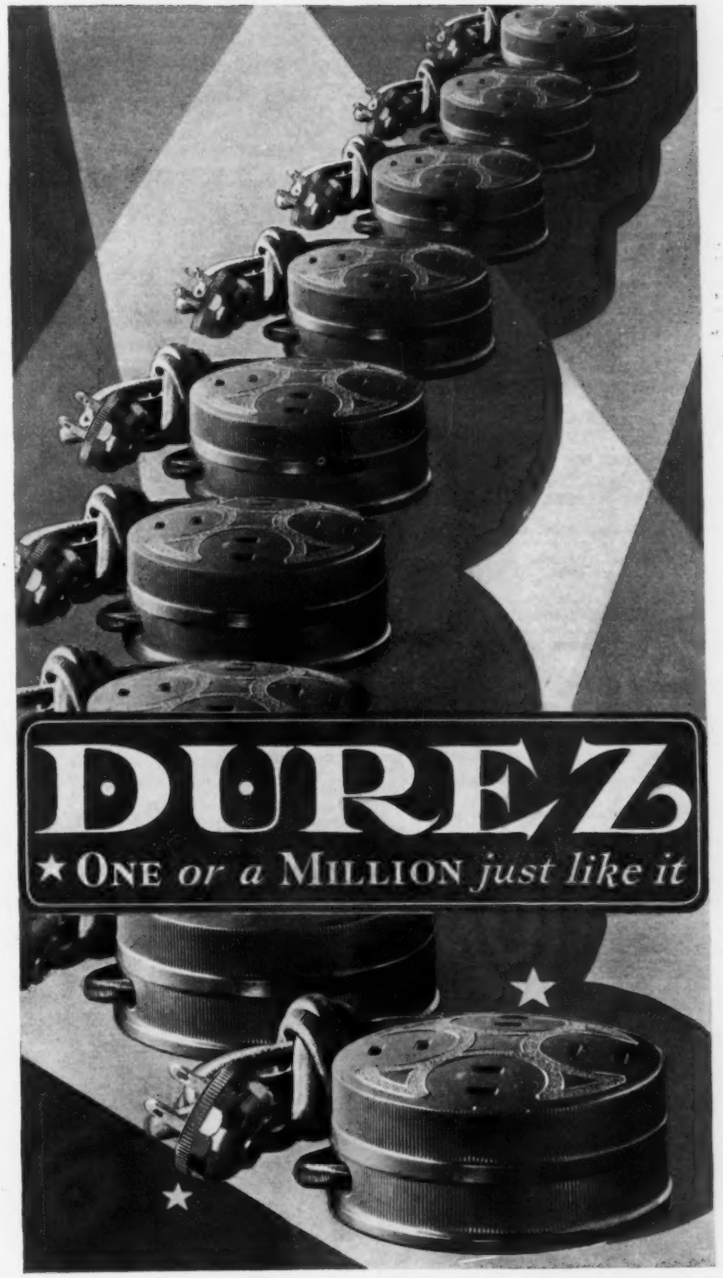
LUGS, Copper

Anderson Mfg. Co., Albert & J. M., 289 A St., Boston, Mass
Dante Elecl. Mfg. Co., Bantam, Conn.
French Mfg. Co., Waterbury, Conn.
General Electric Co., Schenectady, N. Y.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Wolverine Tube Co., 1433 Central Ave., Detroit, Mich.

LUMINOUS SPECIALTIES

KEY
Luminous Compound .....See C
Pendants (Bulbs) .....See P
Standard Parts .....See S
Acornlite Studios, 675 72nd, Brooklyn, N. Y..... P

Modernize· it with DUREZ



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Do not confuse Durez with any other molding compound. Durez is a basic-formula material—not an offspring; not just a name. Complete laboratory and engineering assistance are available to you. General Plastics, Incorporated, 39 Walck Road, North Tonawanda, N. Y. Also New York City, Chicago, San Francisco.

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SHAW

FOUNDED 1892

Insulator Company

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"Quality that Qualifies"

We are Custom Moulders of

Bakelite *and* Durez Parts

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We can help you on

MOLDING *in* BAKELITE—

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Ohio

LUMINOUS SPECIALTIES—Continued

Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. ..... S P
Bryant Electric Co., Bridgeport, Conn. ..... P
Connecticut Elec. Mfg. Co., Bridgeport, Conn. ..... S
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis.
Eaglite. See Eagle Elec. Mfg. Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y. ..... P
General Electric Co., Section W-233, Merchandise Dept., Bridgeport, Conn. ..... S P
Glow Lite. See Rodale Mfg. Co.
Glow Tip. See Arrow Electric Co.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Electric Co., Hartford, Conn. ..... S P
Hubbell, Inc., Harvey, Bridgeport, Conn. ..... P
Luma & Luma Lite. See Radium Dial Co.
Radieye. See General Electric Co.
Radium Dial Co., 3582 Forbes, Pittsburgh, Pa. .... C P
Reynolds Spring Co., Jackson, Mich. ..... S
Rodale Mfg. Co., 200 Hudson, New York, N. Y. ..... P
Seelite. See T. C. Smith & Co.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia .. P
Spot O Life. See Hart & Hegeman Mfg. Co.
Undark. See United States Radium Corp.
United States Radium Corp., 535 Pearl, New York, N. Y. ..... C S P

MACHINE SCREWS. See Screws, Machine.
MACHINE SCREW PRODUCTS. See Screw Machine Products.

MACHINES

Armature Banding. See Banding Machines, Armature
Armature Notching. See Notching Machines, Armature
Balancing. See Balancers, Armature.
Banding. See Banding Machines, Armature.
Cable Armoring. See Wire Manufacturing Machines.
Coil Shaping. See Shaping Machines, Coil.
Coil Taping. See Taping Machines, Coil.
Coil Winding. See Winding Machines.
Commutator Slotting. See Mica Undercutters.
Engraving. See Engraving Machines.
Incandescent Lamp Making. See Machines, Lamp Making
Molded Insulation. See Presses, Molded Insulation.
Perforating. See Perforating Machines.
Porcelain Molding. See Presses, Porcelain Molding.
Radio Tube. See Machines, Lamp Making.
Shaping. See Shaping Machines, Coil.
Slotting. See Mica Undercutters.
Soldering. See Soldering Machines, Commutator.
Spring Making. See Spring Making Machines.
Taping. See Taping Machines, Coil.
Tension. See Tension Machines, Band Wire.
Winding. See Winding Machines.
Wire, Armoring. See Wire Manufacturing Machines.
Wire Drawing. See Wire Drawing Machinery.
Wire Insulator. See Wire Manufacturing Machines.
Wire Measuring. See Wire Manufacturing Machines.
Wire Tension. See Tension Machines, Band Wire.
Wire Wrapping. See Wire Wrapping Machines.

MACHINES, Lamp Making

For Making Incandescent Lamps and Vacuum Tubes.
Arrow Mach. Co., 527 Hackensack Plank Rd., Union City, N. J.
Berrenberg, R., 12 Farnham (Roxbury), Boston, Mass (Vacuum Pumps.)
Dwyer Machine Co., Lynn, Mass.
Eisler Engineering Co., 770 S. 13th, Newark, N. J.
General Engineering & Supply Co., 160 5th Ave., New York. N. Y. Filament Winder.
Gesco. See General Engineering & Supply Co.
Sleeper & Hartley, Inc., Worcester, Mass.
York Elec. & Machine Co., 30 Penn, York, Pa.

MACHINES, Spring Making. See Spring Making Machines
MACHINES, WIRE MANUFACTURING. See Wire Manufacturing Machines.
MAGNET CHARGERS. See Chargers, Magnet.
MAGNET STEEL. See Steel, Magnet.
MAGNET TESTERS. See Instruments, Portable and Switchboard; also Instruments, Pocket.
MAGNET WIRE MACHINES. See Enameling Machines for Magnet Wire.
MAGNETIC CHUCKS. See Chucks, Magnetic.
MAGNETIC CLUTCHES. See Clutches, Magnetic.
MAGNETOMETERS. See Instruments, Pocket.

MAGNETS, Permanent

Bulleos Co., D. K., Pottstown, Pa.
Ind. Steel Products Co., 4545 S. Western Blvd., Chicago
Rogers Drop Forging Co., Worcester, Mass.
Stromberg-Carlson Tel. Mfg. Co., Rochester, N. Y.
Stieht & Co., H. H., 13 Park Row, New
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.

MALLETS, Raw Hide

Chicago Rawhide Mfg. Co., 1313 Elston Ave., Chicago, Ill.
Crude Pelt. See Chicago Rawhide Mfg. Co.
Holbrook Raw Hide Mfg. Co., 748 N. Main, Providence, R. I.

MANGANESE, Battery. See Chemicals, Battery.
MEASURING INSTRUMENTS. See Instruments.
METAL CUTTING OUTFITS. See Welding and Cutting
MECHANICAL RUBBER GOODS. See Rubber Mechanical Goods.
MEGOHMMETERS. See Instruments, Laboratory Standard
MERCURY SWITCHES. See Switches, Mercury.
METAL CLEANERS (Compound). See Cleaners, Metal.
Outfits.
METAL FINISHING. See Plating & Finishing.
METAL MARKING OUTFITS. See Engraving Machines
METALLIC SHADES. See Shades, Metallic.
METERS. See Instruments.
MICA SHADES. See Shades, Mica.
MICA TAPE. See Tape, Mica.
MICA UNDERCUTTERS. See Slotting Machines & Tools-Commutator.

MICA

Asheville Mica Co., Biltmore, N. C.
Asco. See Schoonmaker Insulation Co.
Brand & Co., William, 268 Fourth Ave., New York, N. Y.
Chicago Mica Co., 345 Campbell, Valparaiso, Ind.
Colonial Mica Co., 136 Seventh, Jersey City, N. J.
Fillion, S. O., 68 Murray, New York, N. Y.
Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y.
Gerdau Co., Otto, 533 Canal, New York, N. Y.
Hirsch Mica Co. 1087 Flushing Ave., Brooklyn, N. Y.
Huse-Liberty Mica Co., 73 Long Wharf, Boston, Mass.
International Mica Co., 3660 Brandywine, Philadelphia, Pa
Kant Krack. See Huse Liberty Mica Co.
Keene Mica Co., Keene, N. H.
Macallen Co., Boston 27, Mass.
Micabond. See Chicago Mica Co.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mica Mfg. Co., 135 Johnson, Brooklyn, N. Y.
Micanite. See Mica Insulator Co.
Mica Products Mfg. Co., 54 Greene, New York, N. Y.
Minerals & Insulation Co., 54 Greene St., New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Miralite. See Mitchell-Rand Mfg. Co.
Mumsell & Co., Eugene, 200 Varick, New York, N. Y.
Nemco. See New England Mica Co.
New England Mica Co., Waltham, Mass.
New England Minerals, Inc., 85 Devonshire, Boston, Mass.
New York Mica & Mfg. Co., Auburn, N. Y.
Peerless. See New England Mica Co.
Prestonite. See Robt. K. Preston Mica Co.
Preston Mica Co., Robt. K., 957 Monadnock Blk., Chicago. (Ground Mica.)
Red Streak. See Huse Liberty Mica Co.
Rogers-Pyatt Shellac Co., 81 Water St., New York. (Imp.)
Schoonmaker Insulation Co., A. O., 34 University Place, New York, N. Y.
Storrs Mica Co., 11 Park Place, New York, N. Y.
Tar Heel Mica Co., Plumtree, N. C.
Watson Bros., 170 Purchase, Boston, Mass.

MINIATURE SWITCHBOARD SYSTEMS. See Instruments, Portable and Switchboard.

MIXERS, INSULATION. See Insulation Mixers.

MOLDED

Presses. See Presses, Molded Insulation.
Radio Parts. See Radio Molded Parts.
Shades. See Molded Insulation.

MOLDED INSULATION

Aico. See American Insulator Corp.
Allen & Hills, Inc., Auburn, N. Y.
American Insulator Corp., New Freedom, Pa.
American Machine & Foundry Co., 5520 Second Ave., Brooklyn, N. Y.
Amerine. See American Insulator Corp.
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Asbestos Shingle Slate & Sheathing Co., Ambler, Pa. (Cold.)
Auburn Button Wks., Auburn, N. Y.
Bakelite Corp., 247 Park Ave., New York, N. Y.
Bay State Moulding Co., 1197 Dorchester Ave., Boston.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Beldenmold. See Belden Mfg. Co.
Bell Mfg. Co., 11 Elkins, Boston, Mass. Radio Parts.
Boonton Molding Co., Boonton, N. J.
Boonton Rubber Mfg. Co., 223 Fanny Rd., Boonton, N. J.
Brewlite Moulding Corp., 109 Hudson, Jersey City, N. J. (Wood Composition.)
Celoron Co., Bridgeport, Pa.
Cetelite. See Connecticut Molded Products Corp.
Cetec. See Connecticut Molded Products Corp.
Capco. See Connecticut Molded Products Corp.
Coltrock. See Colt's Patent Firearms Mfg. Co.
Charmond Elec. Corp., 30 Church, New York, N. Y.
Chicago Molded Products Co., 2140 Walnut, Chicago, Ill.
Cincinnati Molding Co., 2037 Florence Ave., Cincinnati, O.
Colasta Co., Hoosick Falls, N. Y.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Compo-Site, Inc., 207 Astor, Newark, N. J.
Condensite. See Bakelite Corp.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Connecticut Molded Products Corp., Meriden, Conn. (Cold.)
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Dayton Insulating Moulding Co., 434 E. First, Dayton, Ohio.
Diemoulding Production Co., Canastota, N. Y.
Dimec. See Dayton Insulating Moulding Co.
Durez. See General Plastics, Inc.
Electrose. See Insulation Mfg. Co.
Erinoid Co., Park Row Bldg., New York, N. Y.
Evercool. See Bakelite Corp.
Formica Insulation Co., 4638 Spring Grove Ave., Cincinnati, O.
Garfield Mfg. Co., Garfield, N. J. Composition. (Cold.)
General Electric Co., Schenectady, N. Y.
General Moulded Composition Co., 212 Market, Lynn, Mass.
General Plastics, Inc., 29 Walck Rd., N. Tonawanda, N. Y.
Gummor. See Garfield Mfg. Co.
Hahn Mfg. Co., Harry W., 623 S. San Pedro, Los Angeles, Cal.
Herculite. See Colosta Co.
Hi-Heet. See Insulation Mfg. Co.

GARFIELD MOLDED COMPOSITIONS

Reduce Costs Strong Heat Proof

GARFIELD MANUFACTURING CO.

Garfield, N. J. *Established 1908*

Imperial Molded Products Co., 2925 W. Harrison, Chicago.
Imptoco. See Insulation Products Co.
Inda. See American Machine & Foundry Co.
Insulation Mfg. Co., New York Ave. and Herkimer St., Brooklyn, N. Y.
Insulation Products Co., 404 Richland, Pittsburgh, Pa.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
International Insulating Corp., Elyria, O.
Johnson Molding & Tool Co., Weymouth, Mass.
Karolith Corp., 189 13th, Long Island City, N. Y. (Casein plastics.)
Kellite. See Kellogg Switchboard & Supply Co.
Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Klagges, Chas., 128 147th, Ozone Park, N. Y.
Kuhn & Jacob Machine & Tool Co., 502 Prospect Ave., Trenton, N. J.
Kurz-Kasch Co., Dayton, O.
Lacanite. See Scranton Button Co.
Macallen Co., Boston, 27, Mass.
Mack Molding Co., Little Falls, N. J.
Makalot. See Johnson Molding & Tool Co.
Manchester Mfg. Co., Manchester Depot, Vt.
Megohom. See Waterbury Button Co.
Micarta Fabricators, Inc., 309 Canal, New York, N. Y.
Micarta. See Westinghouse Elec. & Mfg. Co.
Modern Molded Products Co., Blount and Elm Sts., Providence, R. I.
New England Products Co., 232 Greenwich, New York, N. Y.
Niagara Insul-Bake Specialty Co., 483 Delaware Ave., Albany, N. Y.
Nixon Nitration Works, Nixon, N. J.
Nixonoid. See Nixon Nitration Works.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Norloc. See Norton Laboratories, Inc.
Northern Industrial Chemical Co., 11 Elkin, South Boston.
Norton Laboratories, Inc., 1025 Mill, Lockport, N. Y.
Panelyte Co., Enterprise Ave., Trenton, N. J.
Paramix. See Splitdorf Radio Corp.
Paratherm. See Scranton Button Co.
Phenolic. See Scranton Button Co.
Pruven Compositions Products Corp., Milford, Conn.
Pruvenite. See Pruven Composition Products Co.
Pyrolax. See Cutler-Hammer Mfg. Co.
Recto Mfg. Co., 23 W. 3rd, Cincinnati, O.
Redmonol. See Bakelite Corp.
Rexlite. See Northern Industrial Chemical Co.
Reynolds Spring Co., Jackson, Mich.
Reynoldite. See Reynolds Spring Co.
Reynomold. See Reynolds Spring Co.
Richardson Co., Lockland, Cincinnati, O.
Ridgelite. See Ridgley Trimmer Co.
Ridgley Trimmer Co., Springfield, O.
Schneider Bros., Inc., 312 N. Sheldon Ave., Chicago.
Scranton Button Co., Scranton, Pa.
Shaw Insulator Co., Irvington, Newark, N. J.
Siemon Co., State and Dewey, Bridgeport, Conn.
Specialty Insulation Mfg. Co., Hoosick Falls, N. Y.
Star Insulate. See Insulation Mfg. Co.
Starlite. See Insulation Mfg. Co.
Stokes & Smith Co., Summerdale Ave. near Roosevelt Blvd., Philadelphia, Pa.
Synthane Corp., Oaks, Pa.
Textolite. See General Elec. Co.
Thermoplax. See Cutler-Hammer Mfg. Co.
Tegit. See Garfield Mfg. Co.
Union Insulating Co., Parkersburg, W. Va.
Vulcabeston. See Colt's Patent Fire Arms Mfg. Co.
Vulcanized Rubber Co., 251 Fourth Ave., New York, N. Y.
Waterbury Button Co., Waterbury, Conn.
Watertown Mfg. Co., Watertown, Conn.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

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Elkon, Inc. (Div. of P. R. Mallory Co.), 350 Madison Ave., New York, N. Y.
Lohfeld & Co., J. L., 53 Park Place., New York, N. Y.
Palatine Industrial Co., 111 Fifth Ave., New York, N. Y.
Radiotherma, Inc., 45 E. 17th, New York, N. Y.
Sirian Wire Co., 255 Sherman Ave., Newark, N. J.

MONEL METAL

International Nickel Co., 67 Wall, New York, N. Y.

MOTOR CONTROLLERS. See Controllers, Motor.
MOTOR PLATFORM BASES. See Bases, Motor Platform.
MOTOR STARTERS. See Controllers, Motor; Switches, Remote Control; Switches, Motor Starting; Safety; Switches Snap (Heavy Duty).

MOTORS

Alternating Current ..... See S
Direct Current ..... See S
Motors, 1 Hp. up ..... See M
Motors Fractional Hp. ..... See F
Universal ..... See U

Autodector. See Roth Bros. & Co.
Advance Elec. Co., 4311 Maple Ave., St. Louis M F S ..
Allis-Chalmers Mfg. Co., Milwaukee, Wis. ..... M .. S ..
Allis Co., Louis, Milwaukee, Wis. ..... M .. S ..
American Elec. Motor Co., Cedarburg, Wis. ..... M .. .. ..
Apex Electl Mfg. Co., 1067 E. 152nd, Cleveland .. F S U
Armor Elec. Mfg. Co., 1020 Holland, Erie, Pa. M .. .. ..
Baldor Elec. Co., 4352 Duncan Ave., St. Louis M F S ..
B-Line. See Brown-Breckmeyer Co.
Bodine Elec. Co., 2254 Ohio, Chicago ..... F S U
Bogue Elec. Co., Chas. J., 132 King, New York M .. .. ..
Brown-Brockmeyer Co., Norwood Power Bldg., Dayton, O ..... M F .. ..
Burke Elec. Co., Erie, Pa. ..... M F S U
B. T. See Allis Co., Louis.
B & R Mfg. Co., 812 Lafayette, Toledo, O. ..... F .. ..
Century Elec. Co., 1806 Pine, St. Louis, Mo.. M F S ..
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Crocker-Wheeler Elec. Mfg. Co., Ampere, N. J. M .. S U
Cushman Elec. Co., Concord N. H. ..... M F S ..
Day-Fan Electric Co., Dept. A, Dayton, O. .... .. F S ..
Diehl Mfg. Co., Elizabeth, N. J. ..... M F S ..
Diverter Pole. See Rochester Elec. Product Co.
Domestic Electric Co., 7209 St. Clair Ave., Cleveland, O. .... S U
Dumore. See Wisconsin Elec. Co.
Eclipse. See Fidelity Elec. Co.
Electric Machinery Co., Minneapolis, Minn.. M .. S ..
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O. ....
Electric Specialty Co., 221 South Stamford, Conn. M F S U
Electro-Dynamic Co., Bayonne, N. J. ..... M .. S ..
Emerson Electric Mfg. Co., 2014 Washington Ave., St. Louis, Mo. ..... M F S U
Engberg's Elec. & Mechl. Works, St. Joseph, Mich. ..... M .. S ..
Esco. See Electric Specialty Co.
Fairbanks-Morse & Co., 900 S. Wabash Ave., Chicago, Ill. ..... M F .. ..
Fidelity Elec. Co., Lancaster Pa. ..... M F S U
Fitzgerald Mfg. Co., Torrington, Conn. .... F .. ..
Fynn Weichsel. See Wagner Elec. Corp.
Galvin Elec. Mfg. Co., 3314 S. Broadway, St. Louis, Mo. .... F .. S ..
General Elec. Co., Schenectady, N. Y. ..... M F S U
Gilbert Co., A. C., New Haven, Conn. .... F .. U
Hamilton Beach Mfg. Co., Racine, Wis. .... F S U
Hobart Bros. Co., Troy, O. ..... M .. S ..
Holtzer-Cabot Elec. Co., 125 Amory, Boston... M F S ..
Howell Elec. Motors Co., Howell, Mich. ..... M .. S ..
Ideal Elec. & Mfg. Co., Mansfield, O. ..... M .. S ..
Imperial Electric Co., Akron, O. ..... M .. S ..
Janette Mfg. Co., 556 W. Monroe, Chicago. .... F S ..
Jantz & Leist Elec. Co., Cincinnati, O. ..... M F .. ..
Jeannin Electric Co., Fassett & N. Y. C. R. R. Toledo, O. ..... M F S ..
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Kimble Elec. Co., 634 N. Western Ave., Chicago M .. S U
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Leland Elec. Co., Dayton, O. .... F S ..
L. E. See Leland Elec. Co.
Lincoln Elec. Co., Cleveland, Ohio. ..... M .. S ..
Line-Weld. See Lincoln Elec. Co.
Linzee Elec. Motor Co., Mansfield, O. ..... M .. .. ..
Mando Co., Syracuse, N. Y. .... F .. ..
Marathon Elec. Mfg. Co., 32 Island, Wausau, Wis. .. F .. ..
Marble-Card Elec. Co., Gladstone, Mich. ..... M .. .. ..
Master Electric Co., Dayton, O. ..... M F S ..
MC. See General Electric Co.
Michigan Elec. & Mfg. Co., Lake Linden, Mich. .. F S ..
N. C. See Electric Controller & Mfg. Co.
Norfolk. See Walter Elec. Mfg. Co.
North East Elec. Co., Rochester, N. Y. .... F .. U
Northwestern Mfg. Co., 480 Clinton, Milwaukee M .. .. ..
Ohio Elec. & Controller Co., 5905 Maurice Ave., Cleveland, Ohio .... F S ..
O. K. See Marathon Elec. Mfg. Co.
Osann Co., F., 245 Seventh Ave., New York M .. .. ..
Peerless Elec. Co., 740 W. Market St., Warren, O. M F S U
Polar Cub. See Gilbert Co., A. C.
Pow-R-Full. See Wagner Elec. Corp.
Reco. See Reynolds Electric Co.
Red Band. See Howell Elec. Motors Co.
Reliance Elec. & Engrg. Co., 1042 Ivanhoe Rd., Cleveland, O. ..... M .. S ..
Reynolds Electric Co., 2650 W. Congress, Chicago .. F S ..
Robbins & Myers, Inc., Springfield, O. ..... M F S U
Roth Bros. & Co., Chicago, Ill. ..... M .. S ..
Standard. See Robbins & Myers Co.
Star Elec. Motor Co., Miller St. & N. J. R. R. Ave., Newark, N. J. ..... M .. S ..
Sterling Elec. Motors, Inc., Telegraph Rd. and Atlantic Blvd., Los Angeles, Cal. ..... M .. S ..
Stow Mfg. Co., Binghamton, N. Y. ..... M F S U
Sturtevant Co., 15 Devonshire (Hyde Park), Boston, Mass. ..... M F S U
Sunlight Electrical Mfg. Co., Warren, O. .... F S ..
Suner Wick. See Master Elec. Co.
Switch start. See Lincoln Elec. Co.
Triumph Elec. Corp., Carthage, O. ..... M .. S ..
Union Elec. Motor Mfg. Co., Hancock & Oxford Sts., Philadelphia, Pa. ..... M F S ..
U. S. Elec. Mfg. Co., 200 E. Slawson Ave., Los Angeles ..... M .. S ..
Valley Elec. Co., 4221 Forest Park Blvd., St. Louis, Mo. ..... M .. S ..
Wagner Elec. Corp., 6400 Plymouth Ave., St. Louis, Mo. ..... M F S U
Walter Elec. Mfg. Co., Norfolk, Va. ..... M .. S ..
Watson. See Allis Co., Louis.
Welco Uniframe. See Wesche Elec. Co., B. A.
Wesche Elec. Co., B. A., 1622 Vine, Cincinnati M F S ..
Westinghouse Elec. Mfg. Co., East Pittsburgh M F S ..
Willey-Wray Elec. Co., Cincinnati, O. ..... M .. S ..
Wisconsin Elec. Co., 35 16th, Racine, Wis. .... .. F .. U
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Electro-Chemical Engraving Co., 52 Vanderbilt Ave., New York, N. Y.
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Etching Co of America, 1520 Montana, Chicago, Ill.
General Etching & Mfg. Co., 3070 W. Grand Ave., Chicago, Ill.
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Premier Metal Etching Co., 14th & Van Alst Ave., Long Island City, N. J.
Waterbury Button Co., Waterbury, Conn.

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Driver-Harris Co., Harrison, N. J.
International Nickel Co., 67 Wall, New York, N. Y.
Seymour Mfg. Co., Seymour, Conn.
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Devine Mfg. Co., J. P., Buffalo, N. Y.
Eberbach & Son Co., Ann Arbor, Mich. (Drying.)
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Freas Thermo Elec. Co., 1206 Grove, Irvington, N. J.
Gehnrich Indirect Heat Oven Co., Long Island City, N. Y.
General Electric Co., Schenectady, N. Y.
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Heidbrink Co., 2633 Fourth Ave., S., Minneapolis, Minn.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Kenworthy, Chas. F., 198 Piedmont, Waterbury, Conn.
Maehler Co., Paul, 2210 Lake, Chicago, Ill.
Miho Co., 717 Sycamore, Cincinnati, O.
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Sargent & Co., E. H., 155 E. Superior, Chicago, Ill.
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Standard Elec. Stove Co., Toledo, Ohio.
Steiner & Co., E. E., 197 E. Kinney St., Newark, N. J.
Stokes Machine Co., F. J., Tabor Rd. (Olney), Philadelphia, Pa.
Swartwout Co., 18522 Euclid Ave., Cleveland, O.
Thelco. See Freas Thermo Elec. Co.
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Young Bros. Co., 6500 Mack, Detroit, Mich.

OXIDES, Battery. See Chemicals, Battery.

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Federal Metallic Packing Co., Wakefield, Mass.
Packtite. See Federal Metallic Packing Co.

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KEY
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Painting, Dipping, Spraying, Vacuum Impregnating.
Paint, Insulating and Acid Proof..See P
Lacquer, Metal Finishing ..... See L

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Ajax. See Sherwin-Williams Co.
Alaka. See Lacquer & Chemical Corp.
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American Lastite Co., 3166 Lincoln Ave., Chicago... P L
Antakwa Co., 1329 Mohawk, Chicago, Ill. ..... P ..
Arizona Lacquer Mfg. Co., 7 16th, Brooklyn, N. Y. L
Armlac. See Robertson Chemical Co.
Arolac. See Arizona Lacquer Mfg. Co.
Art-Craft. See Southwestern Paint & Varnish Co.
Atlantic Chemical Co., Coit, Irvington, N. J. L
Atom Chemical Co., 96 E. 10th, New York, N. Y. L
Wakelite Corp., 247 Park Ave., New York, N. Y. L
Benolite Varnish Co., 501 Columbia Bank Bldg., Pittsburgh ..... V P ..
Berry Bros., Leib & Wight, Detroit, Mich. ..... V .. ..
Billings-Chapin Co., 1163 E. 40th, Cleveland, O.. V .. ..
Biwax Corp., 208 S. La Salle, Chicago, Ill. ..... P ..
Bradley-Hurtz Co., 2626 S. Dearborn, Chicago, Ill. L
Brevolite. See Waukegan Chemical Co.
Calman & Co., Emil, 42 Vernon Blvd., Long Island City, N. Y. ..... V P ..
Carlefield Products Corp., 15 Park Row, New York. V P ..
Chinalac. See Dolph Co., John C.
Cochrane Chemical Co., 432 Danforth Ave., Jersey City, N. J. ..... V P ..
Code 25. See Mitchell-Rand Mfg. Co.
Columbus Varnish Co., 264 Cozzeins, Columbus, O. V .. ..
Comulac. See Martindale Elec. Co.
Dolph Co., John C., 168 Emmet, Newark, N. J.. V P ..
Duco. See Du Pont de Nemours & Co.
Du Pont de Nemours & Co., Wilmington, Del.... P ..
Eastman Kodak Co., Rochester, N. Y. L
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Francbe & Co., 440 Orleans, Chicago, Ill. L
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General Plastics, Inc., 29 Walck Rd., N. Tonawanda, N. Y. ..... V .. ..
George Co., P. D., St. Louis, Mo. ..... V .. ..
G. E. See General Elec. Co.
Glidden Co., Cleveland, O. ..... V P L
H. B. See Maas & Waldstein Co.
Hilo Varnish Corp., Marcy & Flushing Aves., Brooklyn, N. Y. ..... V P L
Impervious Varnish Corp., 421 Wood, Pittsburgh. V P ..
Insulaterite. See Ohmlac Paint & Refining Co.
Insulvar. See Varflex Corp.
Irvington Varnish & Insulator Co., Irvington, N. J. V P L
Kodalak. See Eastman Kodak Co.
Krakles. See Waukegan Chemical Co.
Lacquer & Chemical Corp., 214-40th St., Brooklyn, N. Y. .... P L
Laqueroid. See Glidden Co.
Liberty. See Antakwa Co.
Linolac. See Mica Insulator Co.
Lowe Bros. Co., 450 E. 3rd, Dayton, O. ..... V P ..
Lucas & Co., John, 322 Race, Philadelphia, Pa.. V P ..
Lucote. See Lucas & Co., John.
Maas & Waldstein, 438 Riverside Ave., Newark, N. J. L
McDougall-Butler Co., Inc., Evans Water & Norton, Buffalo, N. Y. ..... V P ..
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O. ..... V .. ..
Mawalac. See Maas & Waldstein.
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Mica Insulator Co., 200 Varick St., New York.... V .. ..
M. I. C. See Mica Insulator Co.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y. V P ..
Nepto Lac. See Lowe Bros. Co.
Nikolas & Co., G. J., 1227 W. Van Buren, Chicago. L
O'Brien Varnish Co., South Bend, Ind. ..... V P L
Ohmlac Refining Co., 140 S. Dearborn, Chicago, Ill. .. P ..
Opex. See Sherwin-Williams Co.
Ozite. See Standard Underground Cable Co.
P. & B. See Ruberoid Co.
Pacoria Paint Co., 4th & Sedgeley Ave., Philadelphia, Pa. L
Padgreen. See George Co., P. D.
Peninsular Paint & Varnish Co., Detroit, Mich. L
Peerless. See Maas & Waldstein Co.
Proxlin. See Acme White Lead & Color Wks.
Pruett-Schaeffer Chemical Co., Taber, Pittsburgh. .. P L
Reliable Leather Dressing Co., 43 Crescent, Long Island City, N. Y. ..... V .. ..
Republic Varnish Co., 200 Thomas, Newark, N. J. V .. ..
Robertson Chemical Co., 9305 Meech Ave., Cleveland, O. ..... V P ..
Rockbestine. See Rockbestos Products Corp.
Rockbestos Products Corp., New Haven, Conn..... V .. ..
S. P. C. See Ruberoid Co.
Schenectady Varnish Co., Schenectady, N. Y..... V P ..
Schorndorfer, Ferbert, 12815 Elmwood Ave., Cleveland, O. ..... V P ..
Sherwin-Williams Co., Cleveland, O. ..... V P L
Sipe & Co., James B., Chamber of Commerce Bldg., Pittsburgh, Pa. L
Southwestern Paint & Varnish Co., 619 Broadway, Kansas City, Mo ..... V P ..
Standard Flexible Comp. Co., 1213 Franklin Trust Bldg., Philadelphia, Pa. ..... V P ..
Standard Insulation Co., Rutherford, N. J..... V .. ..
Standard Lacquer Co., 621 Broadway, New York, N. Y. L
Standard Underground Cable Co., Div. of General Cable Corp., Pittsburgh, Pa. .... P ..
Standard Varnish Wks., 443 4th Ave., New York. V P L
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Varflex Corp., Rome, N. Y. ..... V .. ..
Voltax Co., 99 Reservoir Ave., Bridgeport, Conn. V P ..
Vulcan-Lastite. See American Lastite Co.
Walker Co., Henry V., 17 John St., New York.. L
Walnole. See Robertson Chemical Co.
Waukegan Chemical Co., North Chicago, Ill. L
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Zanon Co., Stamford, Conn. L
Zellac. See Zeller Lacquer Mfg. Co.
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PANELS (panel) Engraving. See Engraving.
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Insulating. See Cloth and Paper.
Parchment. See Parchment Paper.
Shades. See Shades, Fabric.
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Foto Cell. See Raytheon Mfg. Co.
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Kino-Lamp. See Raytheon Mfg. Co.
Photion Instrument Corp., 574 Southern Blvd., New York.
Radio Elec'l Wks., 150 W. 22nd, New York, N. Y.
Raytheon Mfg. Co., Cambridge, Mass.
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Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Luxometer. See James G. Biddle.
Mathews. See Foote, Pierson & Co.
National Lamp Wks of G. E. Co., Cleveland, O.

PICK-UPS, TALKING MACHINE. See Loud Speakers.

PIGTAILS, Commutator. See Brushes, Commutator.
Wire Gauze. See Brushes, Commutator.
Vacuum Cleaner. See Brushes for Vacuum Cleaners.

PINIONS. See Gears and Pinions.

PINION PULLERS. See Pullers, Armature Shaft.

PLASTICS. See Molded Insulation.

PLATES, Name. See Name Plates; Also Decalcomania.

PLATES
Fixture Outlet. See Fixture Fittings.
Storage Battery. See Plates, Storage Battery.

PLATES, Storage Battery
Are Elec'l Corp., 211 E. Columbia, Fort Wayne, Ind.
Champion. See Englert Mfg. Co.
C. & B. Battery Co., 1535 S. State, Chicago, Ill.
Edes Mfg. Co., Plymouth, Mass.
Englert Mfg. Co., 2500 Jane, Pittsburgh, Pa.
Esto. See New Jersey Storage Battery Co.
Fort Wayne Battery Mfg. Co., 230 E. Fourth, Ft. Wayne.
Handler. See Witherbee Storage Battery Co.
Link & Henrick, Inc., 555 W. 52nd St., New York, N. Y.
New Jersey Storage Battery Co., 656 Summit Ave., Union City, N. J.
Universal Battery Co., 3410 S. La Salle, Chicago, Ill.
Witherbee Storage Battery Co., 75 Columbus Ave., New York.

PLATING GENERATORS
American Giant. See Connecticut Dyname Motor Co.
Bogue Elec. Co., Chas. J., 133 King, New York, N. Y.
Burke Elec. Co., Erie, Pa.
Chandeysson Elec. Co., St. Louis, Mo.
Connecticut Dynamor Motor Co., Irvington, N. J.
Conpro. See Eager Elec. Co.
Eager Electric Co., 522 Novell, Watertown, N. Y.
Eclipse. See Fidelity Elec. Co.
Electric Specialty Co., 229 South, Stamford, Conn.
Esco. See Electric Specialty Co.
Fidelity Elec. Co., Lancaster, Pa.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Hobart Bros. Co., Troy, O.
Holtzer-Cabot Elec. Co., 125 Amory, Boston, Mass.
Ideal Electric & Mfg. Co., East Third St., Mansfield, O.

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54 Austin St. Newark, N. J.

Jantz & Leist Elec. Co., Cincinnati, O.
Kendrick & Davis Co., Lebanon, N. H.
L'Hommedieu & Sons Co., Chas. F., 4521 Ogden Ave., Chicago, Ill.
Optimus. See Hanson-Van Winkle & Munning Co.
Reliance. See L'Hommedieu & Sons Co., Chas. F.
Roth Bros. & Co., Chicago, Ill.
Westinghouse Elec. Mfg. Co., East Pittsburgh, Pa.

PLATING AND FINISHING
Chromium Plating, Rust Proofing and other special metal-finishing processes.
Amaloy. See American Machine & Foundry Co.
American Machine & Foundry Co., 5530 Second Ave., Brooklyn, N. Y.
Atlantic Chemical Co., Colt, Irvington, N. J.
Duro Chrome. See General Chromium Corp.
General Chromium Corp., 3220 Bellevue Ave., Detroit, Mich. (Chromium Plate.)
Parker Rust-Proof Co., 2177 E. Milwaukee, Detroit, Mich.
Rochester Elec. Products Corp., 89 Allen, Rochester, N. Y.
United Chromium, Inc., 51 E. 42d, New York, N. Y.
Udylite Process Co., 3230 Bellevue Ave., Detroit, Mich. (Rust-Proof Finish.)

PLATINUM,
Sheet, Rod, Tubing, Wire.
American Platinum Wks., 241 New Jersey Railroad Ave., Newark, N. J.
Baker & Co., Inc., 54 Austin, Newark, N. J.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Interstate Products Corp., 29 Commercial, Newark, N. J.
R. & H. Platinum Works, 709 Sixth Ave., New York.
Wilco. See H. A. Wilson Co.
Wildberg Bros., Smelting & Refining Co., 742 Market, San Francisco, Cal.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

PLUG FUSES. See Fuses and Fuse Wire.

PLUG RECEPTACLES. See Receptacles, Plug.

PLUGS, Flashing. See Flashers, Sign.

PLUGS, Radio. See Radio Receiver Parts.

PLUGS, Attachment
A-1 Bakelite. See Connecticut Elec. Mfg. Co.
Ajax Elec. Specialty Co., 1926 Chestnut, St. Louis, Mo.
Alcor Mfg. Co., 4605 W. Madison, Chicago.
Anselite Elec. Mfg. Co., New Haven, Conn.
Anylite Elec. Co., Fort Wayne, Ind.
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Arro-Grip. See Arrow Elec.
Beardsley & Wolcott Mfg. Co., Waterbury, Conn.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bee-Ell Elec. Mfg. Co., 79 Mercer, New York, N. Y.
Belden Mfg. Co., 2310 B. S. Western Ave., Chicago, Ill. (Special Soft Rubber Plug Furnished with Belden Cords).
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bryant Elec. Co., Bridgeport.
C. H. See Cutler-Hammer Mfg. Co.
Carling Tool & Machine Co., 33 Union Place, Hartford, Conn.
Cemco. See Connecticut Elec. Mfg. Co.
Cetelite. See Connecticut Moulded Products.
Circle F Mfg. Co., Trenton, N. J.
Colts Patent Fire Arms Mfg. Co., Hartford, Conn.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Connecticut Moulded Products Corp., Meriden, Conn.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Diamond, H. See Hart Mfg. Co.
Dreadnaught. See Cutler-Hammer Mfg. Co.
Eagle Elec. Mfg. Co., Dept. ER4, 50 Hall, Brooklyn, N. Y.
Eastman Mfg. Co., Manitowoc, Wis.
Electric Co., 94 Allyn, Hartford, Conn.
Ericson Mfg. Co., 3357 Bradford Rd., Cleveland, O.
Esler Elec. Mfg. Co., 802 S. Adams, Marion, Ind.
Fitzall. See Rodale Mfg. Co.
Gaynor Elec. Co., Inc., Stratford Ave., Bridgeport, Conn.
GE-Flex. See General Electric Co.
General Electric Co., Section W-233, Bridgeport, Conn. (Special Soft Rubber Plug furnished with G. E. Cords.)
Globe Metal Mfg. Co., 2122 E. Hazzard, Philadelphia, Pa.
Gold Seal Elecl. Co. of Ohio, Inc., 250 Park Ave., New York, N. Y.
Gripall. See Beaver Mfg. Co.
Handle Cap. See Beaver Mfg. Co.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Heetach. See Marks Products Co.
Homco. See Bryant Electric Co.
Hoosick Falls Radio & Electrical Parts Mfg. Co., Hoosick Falls, N. Y.
H. & H. See Hart & Hegeman.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Iona Co., Los Angeles, Cal.
Jiffy. See Esler Elec. Mfg. Co.
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y.
Marks Products Co., 23 E. 16th, New York.
Metropolitan Electric Mfg. Co., Blvd. at 14th St., Long Island City, N. Y.
Nelco. See Nelson Elec. Co.
Nelson Elec. Co., Plant City, Fla.
P. & S. See Pass & Seymour.

Paragon Elec. Sales Co., 215 S. Fifth, Philadelphia, Pa.
Pass & Seymour, Solvay Sta., Syracuse, N. Y.
Poloron Elec. Mfg. Co., 20 Bond, New York, N. Y.
Propp Co., M., 534 Broadway, New York.
Quick Catch. See Hubbell, Inc., Harvey.
Real. See Smith & Co., T. C.
Real Diamond. See Smith & Co., T. C.
Reben Electric Mfg. Co., 2024 Gravesend Ave., Brooklyn, N. Y.
Remco. See Reben Elec. Mfg. Co.
Reynolds Spring Co., Jackson, Mich.
Reynolite Masterpiece. See Reynolds Spring Co.
Ripple. See Bryant Elec. Co.
Rodale Mfg. Co., 200 Hudson, New York.
Safegard Elec. Appliance Co., 1015 Chestnut, Philadelphia.
Samson Cutlery Co., 8 Jones, Rochester, N. Y.
Sears, Henry D., 80 Boylston, Boston 11, Mass.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa.
Snapit. See Marks Products Co.
Snoco. See Snow & Co., E. W.
Snow & Co., E. W., Rochester, N. Y.
Spartanette. See Bryant Elec. Co.
Spar Tap. See Bryant Elec. Co.
Speedway Elec. Mfg. Co., 30 Church, New York, N. Y.
Standard. See Cutler-Hammer Mfg. Co.
Suitzall. See Beaver Mfg. Co.
Surefit. See Alcor Mfg. Co.
T. E. C. See Electric Co.
Tedco. See Paragon Elec. Sales Co.
Telitap. See General Elec. Co.
Templus. See Bryant Elec. Co.
Torrid. See Beardsley & Wolcott Mfg. Co.
Trio-Tap. See Rodale Mfg. Co.
Triple Tap. See General Elec. Co.
Twin Tap. See General Elec. Co.
United States Elec. Mfg. Co., 222 W. 14th, New York.
Un-X-Ld. See Speedway Elec'l Mfg. Co.
Utile Mfg. Co., 330 E. Liberty, Lancaster, Pa.
Weber. See Sears, Henry D.
Wellmade Elec. Mfg. Co., Torrington, Conn.
Wilshires. See Iona Co.
Yankee. See Beaver Mfg. Co.

POCKET METERS. See Instruments, Pocket.

POINTS, Contact
American Platinum Wks., 241 New Jersey Railroad Ave., Newark, N. J.
Baker & Co., Inc., 54 Austin, Newark, N. J. (Gold, Platinum, Silver.)
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J. (Platinum and Silver.)
Cohn, Sigmund, 44 Gold, New York, N. Y. (Platinum.)
Elkon, Inc. (Div. of P. R. Mallory Co.), 350 Madison Ave., New York, N. Y.
Fansteel Products Co., North Chicago, Ill.
Hardy Metal Corp., Seattle, Wash.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Independent Contact Mfg. Co., 545 39th, Union City, N. J. (Tungsten.)
Interstate Products Corp., 29 Commercial, Newark, N. J. (Platinum and Silver.)
King Mfg. Corp., Rano & Crowley Sts., Buffalo, N. Y. (Platinum.)
National Contact Co., 83 W. 60th, New York. (Platinum.)
Niehoff & Co., C. E., 230 W. Superior, Chicago. (Platinum.)
R. & H. Platinum Works, 709 Sixth Ave., New York.
Spark-O-Metal. See Hardy Metal Corp.
Wilco. See Wilson Co., H. A.
Wilson Co., H. A., 97 Chestnut, Newark, N. J. (Platinum and Silver.)

POLARITY INDICATORS. See Instruments, Pocket.

POLISHING MACHINES, WIRE. See Wire Polishing Machines.

PORCELAIN
Bushings. See Bushings, Box & Cabinet.
Liquid. See Cement, Liquid Porcelain.
Molding Machine. See Presses, Porcelain Molding.
Reflectors (Enameled). See Reflectors, Porcelain Enameled.
Refractory. See Cores, Resistance Coil.

PORCELAIN, Special Shapes
Akron Porcelain Co., Akron, Ohio.
American Porcelain Co., E. Liverpool, O.
A. P. See Akron Porcelain Co.
Burgess & Co., East Liverpool, O.
Central Porcelain Co., Columbiana, O.
Circle F Mfg. Co., Trenton, N. J.
Colonial Insulator Co., Akron, O.
Connecticut Porcelain Co., Trenton, N. J.
Cook Pottery Co., Trenton, N. J.
Corns China Co., Wellsville, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O.
Globe Porcelain Co., Mulberry St. and St. Joes Ave., Trenton, N. J.
Hartford Faience Co., Hartford, Conn.
Hub-Way Mfg. Co., Hubbard, Ohio.
Illinois Electric Porcelain Co., Macomb, Ill.
Imperial Porcelain Wks., Canal and Mulberry, Trenton, N. J.
Knox Porcelain Corp., Knoxville, Tenn.
Louthan Mfg. Co., East Liverpool, O.
Mercer Porcelain Co., Trenton, N. J.
Metach Refractories Co., East Liverpool, Ohio.
National Porcelain Co., Trenton, N. J.
New Jersey Porcelain Co., Trenton, N. J.
Nu Blac. See Star Porcelain Co.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y.
Porcelava. See Burgess & Co.
Porcelain Products, Inc., Findlay, Ohio.
Square D Company, Detroit, Mich.
Standard Porcelain Co., Leetonia, O.
Standard & Specialty Porcelain Co., Sun Prairie, Wis.
Star Porcelain Co., Muirhead St., Trenton, N. J.
Thomas & Sons Co., R., Lisbon, O.
Trenle Porcelain Co., East Liverpool, Ohio.
Union Elec'l Porcelain Wks., Inc., Trenton, N. J.
Washington Porcelain Co., Washington, N. J.
Woolley, Inc., W. Douglas, East Liverpool, O.

POROUS CUPS
Unglazed earthenware cups for primary (wet) batteries
Colonial Insulator Co., Akron, Ohio.
Maddocks Sons, John, Trenton, N. J.
Ohio Pottery Co., Zanesville, Ohio.
Robinson Clay Products Co., Akron, Ohio.

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POSTS, Binding
Binding Posts, Switch Parts, Stop Points, Contacts, Arms, Levers. See also Radio Mountings.
American Radio Hardware Co., 135 Grand, New York
Bunnell & Co., J. H., 32 Park Pl., New York, N. Y.
Chapman Machine Co., Terryville, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
DeJur-Amsco Corp., 418 Broome, New York, N. Y.
Eby Mfg. Co., Inc., H. H., 4710 Stenton Ave., Philadelphia, Pa.
Ensign. See Eby Mfg. Co., H. H.
Eureka. See Frank W. Morse Co.
Grammes & Sons, Inc., L. F., Allentown, Pa
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Hoosick Falls Radio & Electrical Parts Mfg. Co., Hoosick Falls, N. Y.
King. See Morse Co., Frank W.
Morse Co., Frank W., 289 Congress, Boston. (Spring Grip.)
Nutmeg. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Polk, J. L., 41 Bell Ave., Troy, N. Y.
Premier Elec. Co., Dept. 1223, 3800 Ravenswood Ave., Chicago, Ill.
Quality. See H. H. Eby Mfg. Co.
Queen. See Morse Co., Frank W.
Thomaston Mfg. Co., Thomaston, Conn.
Waterbury Button Co., Waterbury, Conn.

POTENTIOMETERS (Instruments). See Instruments, Laboratory Standard.

POTENTIOMETERS (Radio Control). See Radio Receiver Parts.

POWDERED CARBON. See Carbon, Powdered.

POWER TRANSMISSION CHAIN. See Chain, Power Transmission.

PRESS BOARD. See Cloth and Paper.

PRESSES, Armature Coil
Comstock Mfg. Co., Wilkes-Barre, Pa.

PRESSES, ARMATURE NOTCHING. See Notching Machines, Armature.

PRESSES, Molded Insulation
Burroughs Co., 246 N. Tenth, Newark, N. J.
Dunning & Boschert Press Co., 329 W. Water, Syracuse
Elmes Engrg. Works, Chas. F., 222 N. Morgan, Chicago, Ill
Evans Engrg. Works, Chas. E., 1002 Fulton, Chicago, Ill
Farquhar Co., A. B., York, Pa.
Southwark Fdy. & Mach. Co., 400 Washington Ave., Philadelphia, Pa.
Stokes Mach. Co., F. J., 5926 Tabor Rd., Olney, Philadelphia, Pa.
Terkelson Machine Co., 326 A, Boston, Mass.
Watson-Stillman Co., 75 West St., New York, N. Y.
Wood & Co., R. D., Florence, N. J.

PRESSES, Porcelain Molding
Baird, Andrew, 2715 Newark, Detroit, Mich

PRESSES, Punching
Bench Presses—Power Presses; for Punching & Stamping Sheet Metal.
Ams Machine Co., Max, 101 Park Ave., New York, N. Y.
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., 53rd St. & Second Ave., Brooklyn, N. Y.
Dunning & Boschert Press Co., 329 W. Water, Syracuse
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hyro Mfg. Co., 200 Varick, New York, N. Y.
Loshbough-Jordan Tool & Machine Co., Elkhart, Ind.
Peck, Stow & Wilcox Co., Southington, Conn.

PRISMS, Chandelier. See Crystals, Chandelier

PROJECTOR LENSES. See Lenses.

PULLERS, Armature Shaft
Motor Pulley, Shaft & Pinion Pullers & Extractors
Allen Electric & Equipment Co., Kalamazoo, Mich.
Big Buster. See Premier Elec. Co.
Crane Puller Co., Waltham, Mass.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Duff Mfg. Company, Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Little Giant. See Premier Elec. Co.
Peerless. See Electric Service Supplies Co.
Premier Electric Co., Dept. 1223, 3800 Ravenswood Ave., Chicago, Ill.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill

PULLEYS, Composition
General Electric Co., Schenectady, N. Y.
Rockwood Mfg. Co., Indianapolis, Ind.
Sprucolite Co., Bloomfield, N. J.

PUMPS, Oil Burner
Janette Mfg. Co., 556 W. Monroe, Chicago, Ill
Milwaukee Tank Wks., Milwaukee, Wis.
Monroe Machine Tool Co., 737 W. Jackson Blvd., Chicago
Reflex. See Simplex Oil Heating Co.
Simplex Oil Heating Co., 1199 Eddy, Providence, R. I.
Teesdale Mfg. Co., 427 Market, Grand Rapids, Mich
Zisch Engineering Co., 39 Ave. L, Newark, N. J.

PUMPS, Vacuum
To Exhaust Incandescent Lamps.
Arrow Machine Co., 527 Hackensack Plank Rd., Union City, N. J.
Beach-Russ Co., 50 Church, New York, N. Y.
Bishop & Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, O.
Dunham Co., C. A., 450 East Ohio, Chicago, Ill.
Elmer & Amend, 205 3rd Ave., New York, N. Y.
Eisler Engineering Co., 770 S. 13th, Newark, N. J.
General Electric Co., Schenectady, N. Y.
Hubbard's Sons, Norman, 1 Carlton Ave., Brooklyn, N. Y.
Leiman Bros., 23 Walker, New York, N. Y.
Packard. See Hubbard's Sons, Norman.

PUNCHING PRESSES. See Presses, Punching.

PUNCHING and BENDING, Sheet Steel
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Niagara Mach. & Tool Wks., Buffalo, N. Y.

RACKS, Wire Reel
(With Tension Device Attached).
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Browning. See Mutual Foundry & Machine Co.
Chapman Elec'l Wks., P. E., 1820 Chouteau Ave., St. Louis, Mo. (Tensionless Dereeler)
Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
General Elec. Co., Schenectady, N. Y. (Tension Indicator.)
Mutual Foundry & Machine Co., Atlanta, Georgia.
Segur. See Electric Service Supplies Co.

RADIO CIRCUIT COMPONENTS
This heading includes Inductances (Coils), Capacitors (Condensers), Fixed Resistances, Grid Leaks, Transformers, Choke Coils, and Filters, also Amplifier Units and Kits.
Acme Appar. Corp., 39 Osborne, Cambridge, Mass.
Acme Products Co., Boston, Mass.

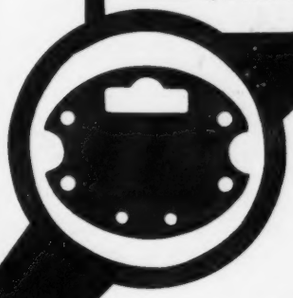
Acme Wire Co., New Haven, Conn.
Aerovox Wireless Corp., 80 Washington, Brooklyn, N. Y.
Aero Products, Inc., 1772 Wilson Ave., Chicago, Ill.
Ajax Elec. Specialty Co., St. Louis, Mo.
Alden Mfg. Co., Springfield, Mass.
All-American Mohawk Corp., 4201 Belmont Ave., Chicago.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Amerchoke. See American Transformer Co.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
American Transformer Co., Newark, N. J
Amperite Rheostat. See Radiall Co.
Arco Elec'l Corp., 211 E. Columbia, Fort Wayne, Ind.
Arctic. See Premier Elec. Co.
Audioformer Transformer. See Pacent Electric Co.
Autoformer. See Thordarson Elec. Mfg. Co.
Automotive Parts Mfg. Co., 70 Washington St., Brooklyn.
B-Conomizer. See Pilot Elec. Mfg. Co.
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bonine. See Turn-it Radio Sales.
Branston Co., Chas. A., 297 Washington, Buffalo, N. Y.
Bremer-Tully Mfg. Co., 520 S. Canal, Chicago, Ill.
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn, N. Y.
Browning-Drake Corp., 110 Brookline, Cambridge, Mass.
Buffer. See Aerovox Wireless Corp.
Buffalo. See De Jur-Amsco Corp.
Camfield. See Columbia Metal Products Co.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Capacigrad. See Pilot Elec. Mfg. Co.
Cardwell Mfg. Corp., Allen D., 81 Prospect, Brooklyn, N. Y.
Carter Mfg. Co., 6300 Euclid Blvd., East Cleveland, O.
Central Radio Corp., Beloit, Wis.
Centraline. See Pilot Elec. Mfg. Co.
Certified Condenser. See Radio Condenser Co.
Chelten Elec. Co., 4859 Stenton Ave., Philadelphia, Pa.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Clarostat Mfg. Co., 281 N. Sixth, Brooklyn, N. Y. (Radio Resistance.)
Cole Radio Mfg. Corp., 536 Bloomfield Ave., Bloomfield, N. J.
Columbia Metal Products Co., 360 E. Grand Ave., Chicago,
Concertone. See Chicago-Jefferson Fuse.
Connectoraids. See Aiden Mfg. Co.
Continental Carbon, Inc., Cleveland, O.
Continental. See Gardiner & Hepburn, Inc.
Counterphase Kit. See Bremer-Tully Mfg. Co.
Creoradio Corp., 166-32 Jamaica Ave., Jamaica, N. Y.
Crefot. See Premier Elec. Co.
Daven Corp., 158 Summit, Newark, N. J. (Kits)
DeForest Radio Co., Jersey City, N. J.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Diamond Weave Coil. See Sickles Co., F. W.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Dubilier Condenser Corp., 4377 Bronx Blvd., New York.
Dumont Elec. Co., 40 W. 17th, New York, N. Y.
Duratran. See Dubilier Condenser Corp.
Durham & Co., 1936 Market, Philadelphia, Pa.
Dymac. See Electrical Products Mfg. Co.
Dynohmic. See Lynch, Inc.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electrad, Inc., 173 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I. (Kit.)
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill.
Electro Motive Engineering Corp., 127 W. 17th, New York.
Elkay. See Langbein Kaufman Radio Co.
Elkon, Inc., 350 Madison Ave., New York, N. Y.
El Menco. See Electro Motive Engineering Co.
Equamatic Kit. See Karas Elec. Co.
Equitrol. See Cardwell Mfg. Corp.
Euphonic. See Bremer-Tully Mfg. Co.
Excelsior Radio Corp., 216 Wallabout, Brooklyn, N. Y.
E-Z. See Polymet Mfg. Corp.
Faradon. See Wireless Specialty Apparatus Co.
Fast Co., John E., Crawford & Barry Ave., Chicago, Ill.
Ferranti, Inc., 130 W. 42nd, New York, N. Y.
Filatrol. See De Jur-Amsco Corp.
Filtrola. See All-American Mohawk Corp.
Fleischhelm Co., A. M., 136 Liberty, New York, N. Y.
Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y.
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind.
F. & H. Radio Laboratories, Fargo, N. D.
Gardiner & Hepburn, Inc., 611 Widener Bldg., Philadelphia, Pa.
General Instrument Corp., 225 Varick, New York, N. Y.
General Radio Co., 30 State, Cambridge, Mass.
General Transformer Corp., 900 W. Jackson Blvd., Chicago.
General Winding Co., 214 Fulton, New York, N. Y.
Gen-Win. See General Winding Co.
Glastor. See Daven Corp.
Globar Corp., Niagara Falls, N. Y.
Glo-Dial. See Wireless Radio Corp.
Gray & Danielson Mfg. Co., 260 1st, San Francisco, Cal.
Halldorsen Co., 4745 N. Western Ave., Chicago, Ill.
Hammarlund Mfg. Co., 424 W. 33rd, New York, N. Y.
Hardwick, Hindle, Inc., 122 Greenwich, New York, N. Y.
Harmonik. See Karas Elec. Co.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. (TRF Kits.)
Heath & Co., Geo. W., 260 First Ave., Newark, N. J.
Hedgehog Transformer. See Premier Elec. Co
Heinemann Elec. Co., Philadelphia, Pa.
Hi-Q Kit. See Hammarlund.
Hum-Dinger. See Clarostat Mfg. Co.
Hy-Wat. See Electro Motive Engineering Corp.
Igrad Condenser & Mfg. Co., 26 Avenue D, Rochester, N. Y.
Infra-Dyne. See Gray & Danielson Co.
International Resistance Co., 2006 Chestnut, Philadelphia, Pa.
Isograd, Isoleak. See Pilot Elec. Mfg. Co.
J-M-P. Mfg. Co., 3329 Fond du Lac Ave., Milwaukee, Wis.
Karas Elec. Co., 4040 N. Rockwell, Chicago, Ill.
Kellford. See American Specialty Co.
Kenyon Transformer Co., 122 Cypress Ave., New York, N. Y.
Kilograd. See Pilot Elec. Mfg. Co.
Krobiack. See Mountford, C. E.
Kuprox. See Kodel Radio Corp.
Langbein-Kaufman Radio Co., 62 Franklin, New Haven, Conn.
Lavite. See Aerovox Wireles Corp.
Lautz Mfg. Co., 245 N. J. R. R. Ave., Newark, N. J (Radio Resistance).
Lekeless. See Benjamin Elec. Mfg. Co.
Lemnis. See General Winding Co.
L. M. C. See Lautz Mfg. Co.
Loftin-White. See Hammarlund Mfg. Co.
Loless. See Wireless Radio Corp.
Lynch, Arthur H., 1775 Broadway, New York, N. Y.
Marco. See Martin-Copeland Co.
Martin-Copeland Co., 101 Sabin, Providence, R. I.
Maxitran. See Electrical Research Laboratories.
Mayolian Corp., 1668 Webster Ave., New York, N. Y. (Tone Filter.)
Meggit. See Cole Mfg. Corp.
Melco-Supreme. See De Jur-Amsco Corp.
Melecoupler. See Robertson-Davis Co.
Meloformer. See Robertson-Davis Co.
Metaleak. See Dubilier Condenser Corp.
Metraligh. See General Instrument Corp.
Micadon Condenser. See Dubilier Condenser Corp.
Micamold Radio Corp., 1087 Flushing Ave., Brooklyn, N. Y (Amplifier Kit.)
Mica-Static. See Dubilier Condenser Corp.
Micon Condenser. See Dubilier Condenser Corp.

Microcondenser. See Sterling Mfg. Co.
Microgrid. See Pilot Elec. Mfg. Co.
Micrometric. See Karas Elec. Co.
Microstat. See Premier Elec. Co.
Midline. See Hammarlund Mfg. Co.
Modern Electric Mfg. Co., Toledo, O.
Mountford, C. E., 30 Sullivan, New York, N. Y.
Muter Co., Leslie F., 76th St. and Greenwood Ave., Chicago, Ill. (Amplifier Kits.)
National Co., 61 Sherman St., Malden, Mass.
Neutre-Grad. See Pilot Elec. Mfg. Co.
New York Coil Co., Mount Clare, Pa.
Nutmeg. See Hart & Hegeman Mfg. Co.
Ohio Carbon Co., 8215 Almira Ave., Cleveland, O.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill. (Resistance.)
Orthometric. See Karas Elec. Co.
Orthophone. See De Jur-Amsco Corp.
Pacent Electric Co., 91 7th Ave., New York, N. Y.
Pam. See Samson Elec. Co.
Panatrol. See Wireless Radio Corp.
Perry Elec'l Resistor Corp., 280 New Main St., Yonkers, N. Y.
Phasatrol. See Electrad, Inc.
Philmore Mfg. Co., 106 7th Ave., New York, N. Y.
Plander. See De Jur-Amsco Corp.
Pierce Airo. See United Scientific Laboratories.
Pilot Elec. Mfg. Co., 323 Berry, Brooklyn, N. Y.
Pilotran. See Pilot Elec. Mfg. Co.
Potter Mfg. Co., North Chicago, Ill.
Polymet Mfg. Corp., 599 Broadway, New York, N. Y.
Power Box. See Scott Sales Co.
Powerohm. See International Resistance Co.
Powrad, Inc., 486 Johnson Ave., Brooklyn, N. Y.
Precision Coil Co., 122 Greenwich, New York, N. Y.
Precise Mfg. Corp., 254 Mill, Rochester, N. Y.
Premier Elec Co., Dept. 1323, 3800 Ravenswood Ave., Chicago, Ill.
Protectoraid. See Alden Mfg. Co.
Pyrohm. See Aerovox Wireless Corp.
Radiall Co., 50 Franklin, New York, N. Y.
Radio Appliance Corp., Springfield, Mass.
Radio Condenser Co., Thorn & Copewood, Camden, N. J.
Radio Engrg. Laboratories, 100 Wilbur Ave., Long Island City, N. Y. (Short Wave Kit.)
Radioloc Switch. See Cutler-Hammer Mfg. Co.
Radio Receptor Co., 106 7th Ave., New York.
Radiostat. See Allen-Bradley Co.
Raola. See Modern Elec. Mfg. Co.
Rauland-Lyric. See All American Mohawk Corp.
Receptrad. See Radio Receptor Co.
Reesonator. See F. & H. Radio Laboratories.
Regal. See American Specialty Mfg. Co.
Reliable Parts Mfg. Co., Wellington, O.
Remler. See Gray & Danielson Co.
Resistaformer. See Aerovox Wireless Corp.
Resistograd. See Pilot Elec. Mfg. Co.
Rittenhouse Co., A. E., Honeoye Falls, N. Y. (Sole Selling Agent), Hatheway & Co., 16 Hudson, New York, N. Y.
Roberts Condenser. See Hammarlund Mfg. Co.
Robertson-Davis Co., 412 Orleans, Chicago, Ill.
Samson Elec. Co., Canton, Mass. (TRF Kits.)
Sangamo Elec. Companies, Springfield, Ill.
Scanlan Elec. Mfg. Co., 1113 N. Franklin, Chicago, Ill. (Output Transformers.)
Scovill Mfg. Co., Waterbury, Conn.
Senior. See All American Mohawk Corp.
Sensory. See Heinemann Electric Co.
Sevison Magneto Engr. Co., 397 Phillips, Toledo, O.
Sickles Co., F. W., 130 Union, Springfield, Mass.
Signal Elec. Mfg. Co., Menominee, Mich.
Silver-Marshall, Inc., 846 W. Jackson Blvd., Chicago. (Amplifier Kits.)
Silvertone. See Radio Receptor Co.
S. L. S. See Wireless Radio Corp.
S. L. T. See General Instrument Corp.
Somersolo. See DeForest Radio Co.
Splitmeter. See Premier Electric Co.
Sprague Specialties Co., Dept. M., Quincy, Mass.
Standard Transformer Co., Warren, O.
Sta-Put. See Martin-Copeland Co.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, O.
Stromberg-Carlson Tel. Mfg. Co., 1060 University Ave., Rochester, N. Y.
Submariner. See J-M-P Mfg. Co.
Super Multiformer. See Precise Mfg. Corp.
Supertran Transformer. See Ford Radio & Mica Co.
Symphony. See Modern Elec. Mfg. Co.
Synerodenser. See Precise Mfg. Corp.
Tandem. See Bremer-Tully Mfg. Co.
Telemonic Coil. See Condenser Corp. of America.
Telos Coil. See Condenser Corp. of America.
Thompson-Levering Co., 351 N. 57th, Philadelphia, Pa.
Thordarson Elec. Mfg. Co., Huron & Kingsbury Sts., Chicago.
Tobe Deutschman Co., Canton, Mass.
Tone Control. See Sprague Specialties Co.
Toroid. See All American Mohawk Corp.
Torostyle. See Bremer-Tully Mfg. Co.
Transcript-Clapp Kit. See Samson Electric Co.
Truphonic Amplification. See Alden Mfg. Co.
Tunadapta. See Lynch, Arthur H.
Twin-aud. See Peerless Radio Co.
Twin-Eight Transformers. See Bodine Electric Co.
Two-Ten & Two-Eleven. See Silver-Marshall.
Tyrman Elec. Corp. 143 W. Austin Ave., Chicago, Ill.
Ultra Vario. See Bruno Radio Corp.
Univernier Condenser. See Auburn Button Works.
Universal Electro Chemical Corp., 30 W. 15th, New York.
Universal Winding Co., Boston, Mass.
Variall Condenser. See Muter Co.
Volta. See Universal Electro Chemical Corp.
Waterbury Button Co., Waterbury, Conn.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn, N. Y.
Wireless Specialty Apparatus Co. (J. P.), Boston, Mass.

RADIO HARDWARE. See Radio Mountings.

RADIO MOUNTINGS
Coil Mountings, Coil Sliders and Rods, Switches, Detectors, Detector and Grid Leak Mountings, Panel Brackets, Special Radio Hardware & Trimmings, Metal Dials, Metal Panels, etc.
Aerovox Wireless Corp., 80 Washington, Brooklyn, N. Y.
Alden Mfg. Co., Brockton, Mass.
American Radio Hardware Co., 135 Grand, New York.
Bonza. See Haydon & Haydon.
Carborundum Co., Niagara Falls, N. Y. (Detector.)
Chapman Machine Co., Terryville, Conn.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Durham & Co., 1936 Market, Philadelphia, Pa.
Electrad, Inc., 173 Varick, New York, N. Y.
Etched Products Corp., 90 Tenth, Long Island City, N. Y. (Metal Panels.)
Eureka. See Morse Co., Frank W.
General Etching & Mfg. Co., 3072 West Grand Ave., Chicago, Ill. (Metal Panels & Escutcheons.)
Globe Technolien Corp., Reading, Mass.
Glodial. See Wireless Radio Corp.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Haydon & Haydon, 167 Chambers, New York, N. Y.
Morse Co., Frank W., 291 Congress, Boston, Mass.

1. Frame of mechanism is held securely in top and bottom discs.
2. Lines point to upper and lower discs made of Fibroc Material.



LIGHTS or NO LIGHTS

THE actual size punched FIBROC insulator is a very small part of the assembly of Levolier switches, made by the McGill Manufacturing Company, yet it is a very vital part of the assembly.

Failure to do its job well means the difference between LIGHTS or NO LIGHTS.

The manufacturer of this switch selected FIBROC ONLY after careful tests—FIBROC won its place solely on merit—and is holding that place on the same basis.

FIBROC Punched parts for all kinds of insulation work are accurate, clean-edged, and assemble quickly and easily. There are no culls, no seconds. An exceedingly rigid inspection department guarantees that only perfect parts are delivered.

It will pay you to consider FIBROC punched parts, for insulation in your products.

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Here's a test for felt feet!

THE world-renowned laboratories of Thomas A. Edison, Inc., at Orange, N. J., were testing felt feet for the new Ediphone. The requirements were permanence and indestructibility. BRAWLEY FELT FEET were selected after the most rigid tests, among which was the one illustrated here. A BRAWLEY Felt Foot gripped in a vise could not be torn out nor loosened by any amount of yanking with a pair of 10-inch pliers. It was practically *indestructible.*

SUCH a demonstration points to the vast difference between BRAWLEY Felt Feet and the ordinary makes. Try that test on a few of them and see what quality in material and workmanship can do for these small but important products. Electrical manufacturers of equipment like radio cabinets and battery eliminators owe it to their buyers to equip them with the best and most permanent felt feet on the market. Brawley Felt Feet are shock-proof, do not crack, break off nor deteriorate, and protect smooth surfaces from scratching. The difference in price is negligible, but the gain in efficiency and satisfaction is incalculable.

Look for the name on every piece

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RADIO MOUNTINGS—Continued
Muter Co., Leslie F., 76th and Greenwood Ave., Chicago.
Na-Ald. See Alden Mfg. Co.
Union Insulating Co., 296 Broadway, New York, N. Y.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn.
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.

RADIO PANEL ENGRAVING. See Engraving, Radio Panel.

RADIO RECEIVER PARTS

Rheostats, Sockets, Plugs, Jacks.
Acme Elec. & Mfg. Co., 1652 Rockwell, Cleveland, Ohio.
Alden Mfg. Co., Springfield, Mass.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
Automotive Equipment Co., 317 Halsey, Newark, N. J.
B. M. S. See Brooklyn Metal Stamping Corp.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. (Multiple Plugs.)
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Brach Mfg. Corp., L. S., 120 Sussex Ave., Newark, N. J.
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn.
Cabelug. See Jones, Howard B.
Carter Radio Co., 300 S. Racine Ave., Chicago, Ill. (Also Socket Adapters.)
Central Radio Laboratories, 14 Keefe Ave., Milwaukee.
Centralab. See Central Radio Laboratories.
Clarostat Mfg. Co., 285 N. Sixth, Brooklyn, N. Y.
Cle-Ra-Tone. See Benjamin Elec. Mfg. Co.
D. A. Radio Co., 80 Hollister, Buffalo, N. Y.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
De Veau. See Stanley & Patterson.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Duostat. See De Jur-Amsco Corp.
E-Z. See Polymet Mfg. Corp.
Eby Mfg. Co., H. H., 4710 Stenton Ave., Philadelphia, Pa.
Electrad, Inc., 173 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I.
Farall Plug. See Brooklyn Metal Stamping Corp.
Frost, Herbert H., 1142 W. Beardsley, Elkhart, Ind.
Gem-Jac. See Frost, Herbert H.
General Instrument Corp., 325 Varick, New York, N. Y.
General Radio Co., 30 State, Cambridge, Mass.
Gray & Danielson Mfg. Co., 260 First, San Francisco, Cal.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Heinemann Elec. Co., Philadelphia, Pa.
Imp. See Carter Radio Co.
Jones, Howard B., 2226 Wabansia, Chicago, (Multiple Plug.)
Klosner Radio Corp., 1022 E. 178th, New York, N. Y.
Martin-Copeland Co., 101 Sabin, Providence, R. I.
Modu-Plug. See Central Radio Lab.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Muter Co., Leslie F., 76th & Greenwood Ave., Chicago.
Nutmeg. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Pacent Elec. Co., 91 Seventh Ave., New York, N. Y.
Pan-Tab Jack. See Frost, Herbert H.
Philmore Mfg. Co., 106 Seventh Ave., New York, N. Y.
Pilot Elec. Mfg. Co., 323 Berry, Brooklyn, N. Y.
Polymet Mfg. Corp., 599 Broadway, New York, N. Y.
Premier Elec. Co., Dept. 1323, 3860 Ravenswood Ave., Chicago, Ill.
Recto Mfg. Co., 23 W. Third, Cincinnati, Ohio.
Robertson-Davis Co., 361 W. Superior, Chicago, Ill.
Royalty. See Electrad, Inc.
Samson Elec. Co., Canton, Mass.
Socostat. See D. A. Radio Co.
Stanley & Patterson, 150 Varick, New York, N. Y.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio.
Tubestat. See Muter Co.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn.
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.

RADIO RECTIFIER TUBES

Armstrong Elec. & Mfg. Co., 351 Halsey, Newark, N. J.
Cable Supply Co., 80 Union Square, New York, N. Y.
Ceco Mfg. Co., 702 Eddy, Providence, R. I.
Conneway Elec. Laboratories, 406 Jefferson, Hoboken, N. J.
Cunningham, Inc., E. T., 870 Seventh Ave., New York, N. Y.
DeForest Radio Co., Franklin St. & Central Ave., Jersey City, N. J.
Diamond Vacuum Products Co., 4053 Diversey Ave., Chicago
Gold Seal Electrical Co. of Ohio, Inc., 250 Park Ave., New York, N. Y.
La Salle Radio Corp., Div. of Matchless Elec. Co., 145 W. Austin Ave., Chicago, Ill.
Manhattan Elect. Supply Co., 190 Sixth Ave., New York, N. Y.
Northern Mfg. Co., 367 Ogden, Newark, N. J.
Paramount Mfg. Co., 79 Orange, Newark, N. J.
Perryman Electric Co., 33 W. 60th, New York, N. Y.
Radio Corp. of America, 233 Broadway, New York.
Raytheon Mfg. Co., Kendall Square Bldg., Cambridge, Mass.
Revall Mfg. Co., 71 Euclid Bldg., Cleveland, O.
Sonatron Tube Co., 108 W. Lake, Chicago, Ill.
Specialty Appliance Co., 6611 Euclid Ave., Cleveland, Ohio.
Sylvania Products Co., Emporium, Pa.
Televocal Corp., 588 Twelfth, West New York, N. J.
United Radio & Elec. Corp., 500 Chancellor Ave., Irvington N. J.

RADIO TRANSFORMERS. See Radio Circuit Components.

RADIO TUBE BASE BRANDERS. See Engraving, Radio Panel.

RADIO TUBE BASES. See Radio Molded Parts.

RADIO TUBE BULBS (Unfinished). See Bulbs, Glass.

RADIO WIRING HARNESS

Special wiring cable and harness assemblies for radio battery connections, radio tube adapter harness for converting battery operated receivers to A.C. operation; Socket Adapters for Power Tubes; Loud Speaker Extension Cords—This heading also includes auto ignition assemblies.
Afco. See American Fabric Co.
Ajax Elec. Specialty Co., 1926 Chestnut, St. Louis, Mo.
Alden Mfg. Co., Brockton, Mass. (Adapters.)
Alpbus. See Alpha Radio Supply Co.
Alpha Radio Supply Co., 520 Broadway, New York, N. Y.
Alpstrand. See Alpha Radio Supply Co.
American Braiding Co., Holyoke, Mass.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Birnbach Radio Co., 254 W. 31st St., New York, N. Y.
Blue Ribbon. See Crescent Braid Co.
Brach Mfg. Co., L. S., Newark, N. J.
Carter Radio Co., 300 S. Racine Ave., Chicago, Ill. (Adapters.)
Connectoralds. See Alden Mfg. Co.
Cornish Wire Co., 30 Church, New York, N. Y.
Corwico. See Cornish Wire Co.
Crescent Braid Co., Providence, R. I.
Crescent Insulated Wire & Cable Co., Trenton, N. J.
De Luxe, 50 W. Houston, New York, N. Y.
Diamond Braiding Mills, Chicago Heights, Ill.
Echo. See Cornish Wire Co.
Enterprise Mfg. Co., Third & Dauphin Sts., Philadelphia, Pa. (Adapters).
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind. (Adapters.)
Lusterized. See American Braiding Co.
Manhattan Insulated Wire Co., 17 W. 60th St., New York.
Morse Co., Frank W., Boston, Mass.
Power, Inc., Harold J., Medford Hillside, Mass. (Adapters).
Radio Receptor Co., 106 Seventh Ave., New York, N. Y. (Adapters.)
Riga. See Birnbach Radio Co.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio. (Adapters).
Wilkens Mfg. Co., 52 Orawaupun St., White Plains, N. Y.

RADIUM POWDER AND PAINT

Radium Dial Co., 3332 Forbes, Pittsburgh, Pa.
Undark. See United States Radium Corp.
United States Radium Corp., 535 Pearl, New York, N. Y.

RANGE SWITCHES, Rotary Snap. See Switches, Snap, Heavy Duty.

RAWHIDE GEARS. See Gears & Pinions, Rawhide.

READING LAMP BASES. See Bases, Reading Lamp.

REAMERS, Pipe. See Stocks, Dies and Reamers.

RECEPTACLES, Lamp. See Sockets and Receptacles.

RECEPTACLES, Plug, Heavy Duty

	KEY
Battery Charging	See B
Floor Boxes	See F
Welding	See W
Machine Tool	See W
Watertight, Marine, Mine	See M
Car Trailer Connection	See C
Extension	See E

A. B. C. See Anderson Mfg. Co.
Adam Electric Co., Frank, St. Louis, Mo. F
Adapti Co., 2906 E. 72nd, Cleveland, O. F
Anderson Mfg. Co., Albert & J. M., 239 A. Boston, Mass. B W M C E
Appleton Elec. Co., 1703 Wellington Ave., Chicago, Ill. M
Arktite. See Crouse-Hinds Co.
Arnessen Electric Co., 13 Water, New York M
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. F B W
Auth Electrical Specialty Co., 422 E. 53rd, New York, N. Y. E
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill. F W M
Bryant Elec. Co., Bridgeport, Conn. (Also Range Type.) W
Campbell. See Steel City Elec. Co.
Cannon Elec. Development Co., 420 West Ave., 33, Los Angeles, Cal. F
C. E. M. Co. See Conn. Elec. Mfg. Co.
C. H. See Cutler-Hammer Mfg. Co.
Circle F Mfg. Co., Trenton, N. J. M
Conduletto. See Crouse-Hinds Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn. F
Cory & Son, Chas., 183 Varick, New York M
Crouse-Hinds Co., Syracuse N. Y. B W
Cutler-Hammer, Inc., 1238 St. Paul Ave., Milwaukee, Wis. F
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa. C
Elwell Parker Elec. Co., 4222 St. Clair Ave., N. E., Cleveland, O. B
Fielding. See Stanley & Patterson.
Fountain's. See Jenkins Mfg. Co.
Fullman Mfg. Co., Latrobe, Pa. F
Fullman. See Steel City Elec. Co.
General Elec. Co., Section W-233, Merchandise Dept., Bridgeport, Conn. B
Gleason & Co., J. L., 241 Franklin, Boston, Mass. E
H. & H. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. B W
Hessel Co., W. F., 76 Greenwich, New York, N. Y. W M E
Hubbell, Inc., Harvey, Bridgeport, Conn. (Also Range Type.) B W
Indestructible. See Kliegl Bros. Universal.
Jenkins Mfg. Co., Bloomfield, N. J. E
Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y. F B W M
Latrobe. See Fullman Mfg. Co.
Loeffelholz & Co., Milwaukee, Wis. C
Major Equipment Co., 4603 Fullerton ave., Chicago, Ill. M
Neco. See Novelty Elec. Co.
NePage McKenny Co., Armour Bldg., Seattle, Wash. F
Novelty Elec. Co., Tenth & Cherry Sts., Philadelphia, Pa. Q
Ohio Elec. & Controller Co., 5905 Maurice Ave., Cleveland, Ohio W
Ostrander Elecl. Works, W. B., 911 Atlantic Ave., Brooklyn, N. Y.
Prest. See Walker Bros. Co.
Pyle National Co., 1334 N. Kostner Ave., Chicago, Ill. W M C E
Quadrangle Mfg. Co., 30 S. Peoria, Chicago, Ill. (Combination wall bracket and convenience outlet.)
Raleo Mfg. Co., 123 N. Albany Ave., Chicago, Ill.
Russell & Stoll Co., 53 Rose, New York F B W M E
Square D. Co., Detroit, Mich. W
Stanley & Patterson, 150 Varick, New York, N. Y. F
Steel City Elec. Co., Pittsburgh, Pa. F E
Thomas & Betts Co., 15 Park Place, New York, N. Y. F
V. V. Fittings Co., 711 Cherry, Philadelphia, Pa. M
Walker Bros., 1417 Sansom, Philadelphia F E
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. F B W M
Yale. See Electric Products Co.

RECORDERS, Elapsed Time. See Indicators, Operation.

REDUCERS, Socket. See Socket Reducers.

REFLECTOR LENSES. See Lenses.

REFLECTORS, Porcelain Enameled, Steel

ABolite Reflector Co., 7500 Sherman Ave., Cleveland, O.
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Cello, Inc., 96 Prince, New York, N. Y.
Dunlap Co., John, Carnegie, Pa.
Durex. See Wheeler Reflector Co.
Federal Electric Co., 8700 S. State, Chicago, Ill.
Goodlites. See Goodrich Elec. Co.
Goodrich Elec. Co., 1650 Ogden Ave., Chicago, Ill.
Isolux. See Wheeler Reflector Co.
Ivanhoe Division of Miller Co., Cleveland.
Marbelite Art Products Co., 140 N. Robey, Chicago, Ill.
Monk, H. E., 18 Warren, New York, N. Y.
Multi Elecl. Mfg. Co., 210 N. Ogden Ave., Chicago, Ill.
Oamed. See Overbaugh & Ayers.
Overbaugh & Ayers, 411 S. Clinton, Chicago, Ill.
Para Steel. See Wheeler Reflector Co.
Perfection. See Tindall & White.
Philadelphia Elec'l & Mfg. Co., 1228 N. 31st, Philadelphia.
Quad. See Quadrangle Mfg. Co.
Quadrangle Mfg. Co., 30 S. Peoria, Chicago Ill.
Richardson Reflector Co., 16 Hudson, New York, N. Y.
Sturdux. See Benjamin Elec. Mfg. Co.
Tindall & White, 33 W. 60th, New York, N. Y.
Vaporlux. See Wheeler Reflector Co.
Westinghouse Elec. & Mfg. Co., South Bend, Ind.
Wheeler Reflector Co., 275 Congress, Boston, Mass.

REFRIGERANTS. See Chemicals, Refrigeration.

REFRIGERATION CHEMICALS. See Chemicals, Refrigeration.

REFRIGERATOR CABINETS

Airtite. See Rhinelander Refrigerator Co.
Alaska Refrigerator Co., Muskegon, Mich.
Allen Filter Co., 25 S. St. Clair, Toledo, O. (Water Cooler Unit.)
American Refrigerator Corp., Peru, Ind.
Argus Products Co., 174 E. Water, Portland, Ore.
Arlington Refrigerator Co., Arlington, Vt.
Athermos. See Gurney Refrigerator Co.
Baldwin Refrigerator Co., Burlington, Vt.
Banta Refrigerator Co., Clearfield, Pa.
Belding-Hall ElectrICE Corp., Belding, Mich.
Benjamin Electric Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bohn Refrigerator Co., St. Paul, Minn.
Castle Double-Servia. See Home Products Corp.
Cavalier. See Tennessee Furniture Co.
Challenge Refrigerator Co., Grand Haven, Mich.
Champion Refrigerator Co., 206 Lexington Ave., New York, N. Y.
Crystal Refrigerator Co., Fremont, Neb.
Crysteel. See Benjamin Elec. Mfg. Co.
Dry-Air. See Baldwin Refrigerator Co.
Dry-Cold. See Hill & Co.
Economic. See Leonard Refrigerator Co.
Eddy & Sons Co., D., 336 Adams, Boston, Mass.
Erie Art Metal Co. & Erie Metal Furniture Co., Erie, Pa.
General Necessities Corp., General Necessities Bldg., Detroit, Mich.
Gibson Refrigerator Co., Greenville, Mich.
Gloekler Co., Bernard, 1627 Penn Ave., Pittsburgh, Pa.
Gurney Refrigerator Co., Fond du Lac, Wis.
Harder Refrigerator Corp., Cobleskill, N. Y.
Haskelite Mfg. Co., 120 S. La Salle, Chicago, Ill. (Knockdown.)
Heintz Mfg. Co., Front & Olney Aves., Philadelphia, Pa.
Heinz & Munschauer, Superior and Randall, Buffalo, N. Y.
Herrick Refrigerator Co., 1805 River, Waterloo, Iowa.
Hibbard Cabinets, Inc., 6504 Euclid Ave., Cleveland, O.
Hill & Co., C. V., 360 Pennington Ave., Trenton, N. J.
Holderle Bros., Inc., 339 Exchange, Rochester, N. Y.
Home Products Corp., Jackson, Mich.
Howe Scale Co., Rutland, Vt.
Jewett Refrigerator Co., Buffalo, N. Y.
Kingston. See Lorillard Refrigerator Co.
Kleen Kold. See Harder Refrigerator Corp.
Knox Products Co., Fourth & Greenhill Ave., Wilmington, Del.
Knox. See Erie Art Metal Co.
Leonard Refrigerator Co., Div. of Electric Refrigeration Corp., Grand Rapids, Mich.
Liver & Co., C. B., Omaha, Neb.
Loeber Co., Henry G., 151 E. 126th, New York, N. Y. (Ice Cream Cabinet.)
Lorillard Refrigerator Co., 44 Cooper Square, New York.
Louisville Refrigerator Corp., 4460 Louisville Ave., Louisville, Ky.
Louisville Tin & Stove Co., Louisville, Ky.
Mace & Co., L. H., 55 E. 150th, New York, N. Y.
Maine Mfg. Co., Nashua, N. H.
McCray Refrigerator Sales Corp., 2364 Lake St., Kendallville, Ind.
Mowatt Refrigerator Co., 25 Oak Grove, San Francisco, Cal.
Omaha Fixture & Supply Co., 11th and Douglas, Omaha.
Oreole. See Ottenheimer Bros.
Ottenheimer Bros., Baltimore, Md.
Plymetl. See Haskelite Mfg. Co.
Ranney Refrigerator Co., Greenville, Mich.
Reol. See Ottenheimer Bros.
Reolite. See Ottenheimer Bros.
Rex Mfg. Co., Connersville, Ind.
Rexdale. See Rex Mfg. Co.
Rhinelander Refrigerator Co., Rhinelander, Wis.
Saco-Lowell Shops, Newton Upper Falls, Mass.
Sanitary Refrigerator Co., Fond du Lac, Wis.
Schmidt Co., C., John and Livingston, Cincinnati, O.
Seeger Refrigerator Co., St. Paul, Minn.
Sherer-Gillett Co., 601 W. Washington, Chicago, Ill.
Steeprest. See Heintz Mfg. Co.
Success Mfg. Co., Gloucester, Mass.
Tennessee Furniture Co., Chattanooga, Tenn.
Vogt. See General Necessities Corp.
Ward Refrigerator Co., 6901 S. Alameda, Los Angeles, Cal.
White Mountain. See Maine Mfg. Co.
White Seal. See Louisville Refrigerator Co.

REFRIGERATOR CONDENSER UNITS. See Condenser Units, Refrigerator.

REFRIGERATOR FITTINGS

Commonwealth Brass Corp., 5781 Commonwealth Ave., Detroit, Mich.

REGULATORS, Temperature

American Radiator Co., 1807 Elmwood Ave., Buffalo, N. Y. (Mercury Switch Type.)
American Telethern Co., 1017 Summit, Toledo, O.
American Thermostat Co., 226 Jelliff Ave., Newark, N. J.
Automatic Electric Heater Co., 1706 Race, Philadelphia, Pa. (Furnace.)
Automatic Reclosing Circuit Breaker Co., Columbus, O.
Basel Mfg. Co., 911 Mulberry, Kansas City, Mo.
Boston Machine Wks. Co., 7 Willow, Lynn, Mass.
Brown. See Electric Automatic Appliance Co.
Brown Instrument Co., Wayne & Windrim, Philadelphia.
Ceaco. See Cobb Electric Appliance Co.
Cobb Electric Appliance Co., 100 Massachusetts Ave., Boston.
Cook Elec. Co., 2700 Southport Ave., Chicago, Ill.
Davis & Daggett Co., 238 Dwight, Springfield, Mass.
D. & T. Manufacturing Co., 3001 La Salle, St. Louis, Mo.
Electric Automatic Appliance Co., Denver, Col.
Engelhart, Chas., 90 Chestnut, Newark, N. J.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Fireside. See Quincy Stove Mfg. Co.
Gifford Heat Control Systems, 1 Broadway, New York.
Gold Car Htg. & Ltg. Co., 220 36th, Brooklyn, N. Y.
Hart Mfg. Co., Hartford, Conn.
Hermansen Elecl. Co., 505 W. 41st, New York, N. Y.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Jewell Mfg. Co., Auburn, N. Y.
Johnson Service Co., 149 Michigan, Milwaukee, Wis.
Lockswitch. See Time-O-Stat Controls Co.
Majestic Electric Appliance Co., San Francisco, Cal.
Marvel. See American Thermostat Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill. (Mercury Switch.)
Minneapolis-Honeywell Regulator Co., 2753 Fourth Ave., Minneapolis, Minn.
Penn Heat Control Corp., 1207 Race, Philadelphia, Pa.
Powers Regulator Co., 2720 Greenview Ave., Chicago, Ill.
Protectostat. See Minneapolis-Honeywell Regulator Co.
Quincy Stove Mfg. Co., Quincy, Ill.

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Forgetting the fancy verbiage for a moment, let us state a plain fact : we are the largest makers of fibre specialties in the world, and our equipment and production methods are geared to turn out any quantity and shape in fibre in the least possible time. Our punching department has a three-million a day capacity.

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AMERICAN LAVA CORPORATION
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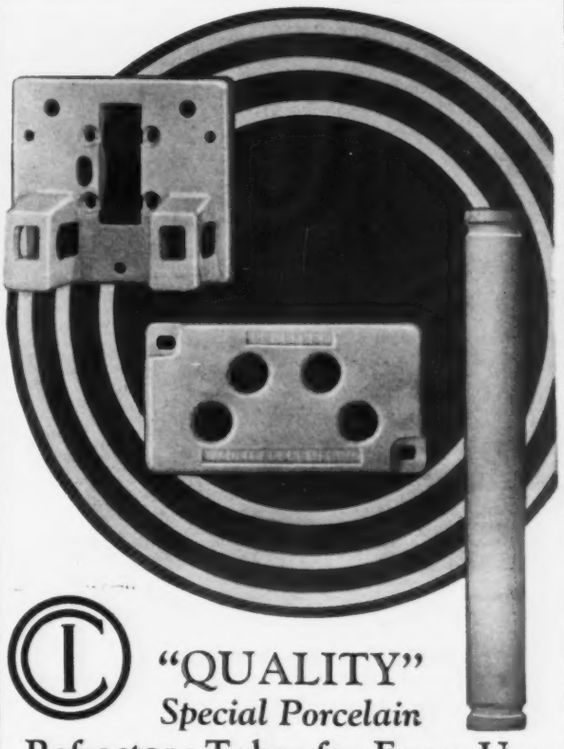
Chattanooga, Tenn.
Manufacturers of Heat Resistant Insulators



"QUALITY"
Special Porcelain
Refractory Tubes for Every Use
COLONIAL INSULATOR CO.
Akron, Ohio *Established 1892*

REGULATORS, Temperature—Continued
Ranco. See Automatic Reclosing Circuit Breaker Co.
Savutime Devices, Inc., 88 Manhattan, Rochester, N. Y.
Sheer Co., H. M., Quincy, Ill.
Simplex Heat Regulator, 2938 Pillsbury Ave., Minneapolis.
Snapon. See Tagliabue Mfg. Co.
Souder-Hornsby Co., Tamaqua, Pa.
Sure Fire. See Boston Machine Wks.
Tagliabue Mfg. Co., C. J., 18 33rd, Brooklyn, N. Y.
Time-O-Stat Controls Co., Cramblet Engineering Div., 286 Milwaukee Ave., Milwaukee, Wis.
Trent Co., Harold E., 429 N. 12th, Philadelphia, Pa.
Webster Elec. Co., Racine, Wis.
Wilcolator Co., 17 Nevada St., Newark, N. J.
Wilson-Maxelin Co., 383 Concord Ave., New York, N. Y.

RELAYS
(See also Circuit Breakers and Thermostats.)
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Dunco. See Struthers Dunn, Inc.
General Electric Co., Schenectady, N. Y.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Signal Engineering & Mfg. Co., 146 W. 14th, New York
Struthers Dunn, Inc., 1133 Race, Philadelphia, Pa.
Wilcolator Co., 17 Nevada, Newark, N. J.
REMOTE CONTROL SWITCHES. See Switches, Remote Control.

REMOVERS, Coil
Ewing Mfg. Company, Middleport, Ohio.

RESISTANCE
Boxes. See Instruments, Laboratory Standard
Coil Cores. See Cores, Resistance.
Test Sets. See Instruments.
Units, Radio. See Radio Circuit Components.
Units. See Units, Rods & Grids.
Wire. See Wire Bare.

RESISTORS
Lautz Mfg. Co., 245 N. J. R.R. Ave., Newark, N. J.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill.
Ward-Leonard Electric Co., Mount Vernon, N. Y.
RESISTORS. See Units, Rods & Grids.
REVOLUTION COUNTERS. See Tachometers.
RHEOSTATS,
Motor-Controlling. See Controllers, also Rheostats.
Radio. See Radio Receiver Parts.
Sewing Machine. See Controllers.

RHEOSTATS

KEY
Battery Charging ..... See B
Stage Dimming ..... See D
Meter Testing (Laboratory) ..... See L
Plating Tank ..... See P
Motion Pictures (Projector Lamp) ..... See M
Motor Starting, Field and Speed Regulating See F

	F	B	D	P	M	L
Allen-Bradley Co., 494 Reed, Milwaukee						L
Biddle, James G., 1211 Arch, Philadelphia						L
Brach Mfg. Corp., L. S., Newark, N. J. (Radio Battery Control.)		B				
Bradleystat. See Allen-Bradley Co.						
Controlite. See Ward Leonard Elec. Co.						
Crown Rheostat & Supply Co., 1910 Park Ave., West Chicago, Ill.				P		
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis.	F	B	D			L
Economic Rheostat Switch Co., 3551 N. 5th, Philadelphia, Pa.	F					
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.	F					
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O.		B				
General Electric Co., Schenectady, N. Y.	F					L
Hanson-Van Winkle-Munning Co., Matawan, N. J.				P		
Holzmuller, C. J., 1108 Howard, San Francisco, Cal.				D		
Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y.			D		M	
Knoeller Elec. Co., De Pere, Wis.	F					
National Elec. Controller Co., 5315 Ravenswood Ave., Chicago	F	B	D		M	L
Optimus. See Hanson-Van Winkle-Munning Co.						
Robertson, Leo F., 536 W. 22nd, New York, N. Y.					M	
Rubicon Co., 29 W. Sixth, Philadelphia, Pa.						L
Schaefer Bros. Co., 1059 W. 11th, Chicago		B				
Simplicity. See Cutler-Hammer Mfg. Co.						
Union Elec. Mfg. Co., Milwaukee, Wis.	F					
Universal. See Ward Leonard Elec. Co.						
Vitrohm. See Ward Leonard Elec. Co.						
Ward Leonard Elec. Co., Mt. Vernon, N. Y.	F		D		M	
Watton. See Electric Products Co.						
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.	F				M	

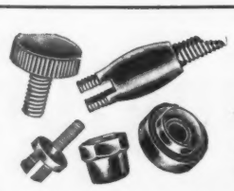
RINGS Seal. See Packing.

RIVETS
Chase Brass & Copper Co., Waterbury, Conn.
Chicago Rivet & Specialty Co., 1830 S. 54th, Chicago, Ill.
Hassall, Inc., John, 402 Oakland, Brooklyn, N. Y.
Hungerford Brass & Copper Co., Div. of The Chase Brass Companies, Inc., 88 Lafayette, New York, N. Y.
Manufacturers Belt Hook Co., 1315 W. Congress, Chicago, Ill.
Merwin Mfg. Co., Bridgeport, Conn. (Solid & Tubular).
Nelson Rivet Co., Taunton, Mass.
Stimpson Co., Edwin B., 70 Franklin Ave., Brooklyn, N. Y.
Thomson Mfg. Co., Judson L., Waltham, Mass.
Tubular Rivet & Stud Co., 87 Lincoln, Boston, Mass.
Waterbury Brass Goods Co., Waterbury, Conn.
Wright & Corson Mfg. Co., Bridgeport, Conn.
RODS, Resistance. See Units, Rods and Grids.
ROLLER BEARINGS. See Bearings, Ball and Roller.

ROLLS, Coil Flattening
Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
RUBBER BELTS. See Belts, Rubber.

RUBBER, Hard
Hard Rubber, Ebonite, Vulcanite.
Aetna Rubber Co., 815 E. 79th, Cleveland, O.
American Hard Rubber Co., 11 Mercer, New York, N. Y.
Connecticut Hard Rubber Co., West Haven, Conn.
Goodrich Rubber Co., B. F., Akron, O.

SCREW MACHINE PRODUCTS AND SPRINGS
for every purpose
WILLIAM STEINEN & COMPANY
297 Washington St. Newark, N. J.


Screw Machine Products
UP TO 2¼ in. DIAMETER
OLSON MFG. CO.
56 Commerical St.
WORCESTER, MASS.

Luzerne Rubber Co., Murhead, near Dewey, Trenton, N. J.
Mahoganite. See American Hard Rubber Co.
New York Hard Rubber Turning Co., 212 Centre, New York.
Panelyte Co., Enterprise Ave., Trenton, N. J.
Radiolite. See Superior Hard Rubber Co.
Stokes Rubber Co., Trenton, N. J.
Superior Hard Rubber Co., Butler, N. J.
U. S. Rubber Co., 1790 Broadway, New York, N. Y.
Vulcanized Rubber Co., 251 4th Ave., New York, N. Y.
Vulco Panels. See Vulcanized Rubber Co.

RUBBER, MECHANICAL GOODS
Goodrich Rubber Co., B. F., Akron, O.
Republic Rubber Co., Youngstown, O.
Sun Rubber Co., Barberton, O.
RUBBER, SEMI-HARD. See Rubber Mechanical Goods.

RUBBER, Sponge
Sun Rubber Co., Barberton, O.
Voycraft Rubber Co., Ashland, O.
RUBBER TAPE. See Tape, Rubber and Friction.
RUBBER TUBING. See Tubing, Rubber.
RUST PROOFING. See Plating & Finishing.
SAL AMMONIAC. See Chemicals, Battery.
SALTS, Battery. See Chemicals, Battery.
SATURATING TANKS. See Wire Manufacturing Machines
SCREW SHELLS, Socket. See Shells, Screw Socket.

SCREW DRIVING MACHINES
Vim Electric Tool Co., 149 Broadway, New York, N. Y.

SCREW MACHINE PRODUCTS
Aluminum Co. of America, 2444 Oliver Bldg., Pittsburgh, Pa.
Barnes Co., Wallace, Bristol, Conn.
Blake & Johnson Co., Waterbury, Conn.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Brighton Screw & Mfg. Co., 1456 Harrison Ave., Cincinnati, O.
Celoron Co., Bridgeport, Pa.
Chapman Machine Co., Terryville, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Colonial-Premier Co., 225 W. Ohio, Chicago, Ill.
Eureka Tool & Machine Co., Newark, N. J.
Faries Mfg. Co., Decatur, Ill.
Hanson, Einar B., 17 Hermon, Worcester, Mass.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Indianapolis Screw Products Co., 621 N. Noble, Indianapolis, Ind.
Linden & Co., 891 Broad, Providence, R. I.
Meisel Press Mfg. Co., 944 Dorchester Ave., Boston, Mass.
Olsen Mfg. Co., 56 Commercial, Worcester, Mass.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Steiner & Co., 297 Washington, Newark, N. J.
Thomaston Mfg. Co., Thomaston, Conn.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Wilmington Fibre Specialty Co., Wilmington, Del.

SCREWS, Cap (Cut Thread)
Bristol Co., Waterbury, Conn.
Hartford Machine Screw Co., Hartford, Conn.

SCREWS, Drive
Parker-Kalon Corp., 190 Varick, New York, N. Y.

SCREWS, Machine
Chicago Nut Mfg. Co., 2513 Cullerton, Chicago, Ill.
Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Hubbell, Inc., Harvey, Bridgeport, Conn.
New England Screw Co., Dept. A, 44 Farnsworth, Boston.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Strong, Carlisle & Hammond, 1392 W. Third, Cleveland, O.

SCREWS, Machine (Cut Thread)
American Screw Co., Providence, R. I.

SECOHMMETERS. See Instruments, Laboratory Standard.
SEGMENTS. See Discs, Armature.

SEPARATORS, Storage Battery
Baltimore Battery Separator Co., Baltimore, Md.
Campbell Elec. Co., Kansas City, Mo.
Carlile & Doughty, 2530 N. Broad, Philadelphia, Pa.
Chattanooga Battery Box Co., Chattanooga, Tenn.
Certified. See Ermet Products Co.
Consumers Rubber Co., 1302 Ontario, Cleveland, O.
Ermet Products Co., Sherman Drive & 16th, Indianapolis, Ind. (Wood.)
Estes & Sons, E. B., 25 Vanderbilt Ave., New York. (Wood.)
Indianapolis Box & Separator Co., 1450 E. 19th St., Indianapolis, Ind. (Wood.)
Indianapolis Mfg. Co., Indianapolis, Ind.
Inseco. See Indianapolis Box & Separator Co.
Link & Hemrick, Inc., 555 W. 52nd, New York, N. Y.
Red Band. See Indianapolis Mfg. Co.
Stewart Mfg. Co., Wm. E., 14th & Elm, Flint, Mich. (Wood.)
Wick Lumber Co., R., 539 W. 52nd, New York. (Wood.)

SHADES
Aluminum. See Shades, Metallic.
Asbestos. See Shades, Fabric.
Bamboo. See Shades, Fabric.
Brass. See Shades, Metallic.
Cast Metal. See Shades and Domes.
Copper. See Shades Metallic.
Cretonne. See Shades, Fabric.
Leaded. See Shades and Domes.
Leather. See Shades, Fabric.
Linen. See Shades, Fabric.
Mica. See Shades, Mica.
Molded. See Molded Insulation.

Mosaic. See Shades and Domes.
Paper. See Shades, Fabric.
Parchment. See Shades, Fabric.
Silk. See Shades, Fabric.
Stamped Metal. See Shades, Metallic; also Shades and Domes.
Steel. See Shades, Metallic.
Tin. See Shades, Metallic.
Zinc. See Shades, Metallic.

SHADES, Fabric
Asbestos Cretonne, Leather, Linen, Paper, Silk, Bamboo, Parchment.
Acme Lamp Shade Co., 630 W. Madison, Chicago. (Silk.)
Adelphi Lamp Shade Co., 242 Fifth Ave., New York. (Silk.)
Admiration Lamp Shade Co., 160 Madison Ave., New York, N. Y. (Silk.)
Andrews Co., C. M., 32 E. 30th, New York, N. Y. (Silk.)
Art Lamp Shade Studios, 316 Fifth Ave., New York, N. Y.
Audrey Art Shade Studios, 105 Thatford Ave., Brooklyn.
Block & Co., L. D., 37 E. 18th St., New York, N. Y.
Borghese. See Hall, Chas.
Daiger Co., Charles V., 76 Essex, Boston, Mass. (Silk.)
Eastern Art Shop, 14 W. 19th, New York. (Parchment.)
Foss Parchment Shade Studio, 1338 E. 12th, Oakland, Cal. (Parchment.)
Foslite. See Foss Parchment Shade Studio.
Frostelene. See Art Lamp Shade Studios.
Gibson Art Co., 223 W. Fourth, Cincinnati, Ohio. (Paper.)
Hall, Chas., 3 E. 40th, New York, N. Y. (Paper Parchment.)
Hanson Co., Paul, 15 E. 26th, New York, N. Y. (Chintz.)
Harris Mfg. Co., 122 University Place, New York, N. Y. (Parchment.)
Herco Art Mfg. Co., Meriden, Conn.
Hoft Studio, 46 W. 21st, New York, N. Y. (Parchment.)
Idealite Elec. Lamp Shade Mfg. Co., 7 E. 17th, New York, N. Y. (Parchment.)
Kapa Shell. See Wardwell, E. H.
Kerwin. See Hall, Chas.
Kno-Glair. See Hamilton, M. E.
Lamb Bros. & Greene Corp., Napannee, Ind. (Silk.)
Luxrite. See John H. St. John.
Maxwell-Ray Co., Milwaukee, Wis. (Silk.)
Monarch Lamp & Shade Co., 210 N. Second, Philadelphia, Pa. (Silk.)
Morimura Bros., 58 W. 23rd, New York. (Bamboo, Silk, Cretonne.)
Parchment Novelty Co., 87 E. 10th, New York, N. Y. (Parchment.)
Patent Lamp Shade Co., 1361 Frankford Ave., Philadelphia.
Peerless Lamp Shade Mfg. Co., 114 E. 25th, N. Y. (Silk.)
R. D Electric Co., Fort Wayne, Ind. (Linen and Silk.)
Reuter, Wm., 32 W. 34th, New York, N. Y. (Silk.)
Rindsberger Mfg. Corp., 22 E. 24th, Chicago, Ill.
Rosita Studio, 10 W. 28th, New York, N. Y. (Parchment and Leatherette.)
Sanderson's Art Co., Milwaukee, Wis. (Parchment.)
Springel & Son, A., 26 S. 3rd, Philadelphia, Pa.
St. John, John H., 1298 Atlantic Ave., Brooklyn, N. Y. (Silk.)
Straus-Hohenstein Co., 133 W. 21st, New York. (Silk.)
Superior Lamp Shade Manufacturers, 72 Madison Ave., New York, N. Y. (Silk.)
Tapestrelle Corp., 44 E. 29th, New York, N. Y.
Tombs Studios, Wm. H., 172 Pennsylvania Ave., Newark, N. J. (Parchment Paper.)
Trio Mfg. Co., 610 N. American, Philadelphia, Pa. (Silk.)
Troy Art Studio, 624 2d Ave., Troy, N. Y.
Utility Shade Co., Tenafly, N. J.
Vogue Lamp & Shade Co., 130 W. 17th, New York, N. Y. (Parchment.)
Volkman Co., 3223 W. Lake, Chicago, Ill.
Wardwell, E. H., 11 E. 36th, New York, N. Y.

SHADES AND DOMES
Leaded, Mosaic or Figured, Stamped or Cast Metal.
Art Shade Co., 223 N. Desplaines, Chicago, Ill.
Badanes Mfg. Co., 62 Greene, New York, N. Y.
Bayley & Sons, 105 Vanderveer, Brooklyn, N. Y.
Mutual Sunset Lamp Co., 21 E. Houston, New York, N. Y.
Royal Art Glass Co., 2572 Park Ave., New York, N. Y.
Western Art Glass Shade Works, 101 Turk, San Francisco.
SHADES, FACTORY WINDOW. See Window Shades, Factory.

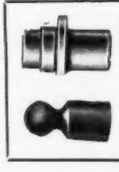
SHADES, Metallic
Tin, Aluminum, Brass, Copper, Zinc, Steel.
A. A. Elec. Mfg. Co., Bridgeport, Conn. (Sole selling agent, Harry Pickhardt, 129 W. 15th, New York, N. Y.)
Durex. See Wheeler Reflector Co.
Faries Mfg. Co., Decatur, Ill. (Brass, Aluminum, Tin, Copper.)
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. (Aluminum, Brass, Zinc, Iron, Steel.)
Hubbell, Inc., Harvey, Bridgeport, Conn. (Aluminum, Brass, Steel, Tin.)
Miller Co., Meriden, Conn.
Monk, H. E., 18 Warren, New York, N. Y. (Tin, Aluminum, Brass, Copper, Zinc & Steel).
Oamco. See Overbaugh & Ayres Mfg. Co.
Overbaugh & Ayres Mfg. Co., 411 S. Clinton, Chicago, Ill.
Richardson Reflector Co., 16 Hudson, New York, N. Y.
Western Reflector Co., 1221 W. Madison, Chicago. (Tin.)
Wheeler Reflector Co., 275 Congress, Boston, Mass.

SHADES, Mica
Hirsch Mica Co., 1087 Flushing Ave., Brooklyn, N. Y.
Huse-Liberty Mica Co., 73 Long Wharf, Boston, Mass.
Kant-Krack. See Huse Liberty Mica Co.
Mica Insulator Co., 200 Varick, New York, N. Y.
Storrs Mica Co., 11 Park Place, New York, N. Y.
Tar Heel Mica Co., Plumtree, N. C.
Tarmillie. See Tar Heel Mica Co.
SHAFT COUPLINGS. See Couplings, Shaft.
SHAFTS, Flexible. See Tubing, Flexible Metallic.

SHAPING MACHINES, Coil
Munsdorf Company, W. P., 720 Frankfort, Cleveland, Ohio

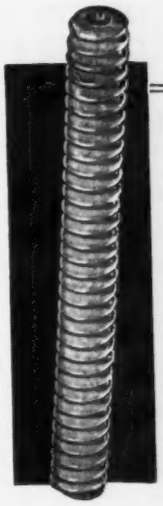
SHEARS, Insulation
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
SHEET STEEL CABINETS. See Cabinets, Sheet Steel.

SHELLS, Screw Socket
Chase Brass & Copper Co., Waterbury, Conn.
Dallas Brass & Copper Co., 820 Orleans, Chicago, Ill.
Patton-MacGuyer Co., Providence, R. I.


SCREW MACHINE PRODUCTS
In Brass or Steel
Send us your specifications for an estimate.
LINDEN & COMPANY
891 Broad St.,
Providence, R. I.

Porcelava

The best for Electric Heating Appliances



Our clay specialties, plain and threaded tubes, and Refractory Porcelain for Electric Heating Appliances are superior in every way; and "PORCELAVA" makes the best Pyrometer Insulation.

Burgess & Company
East Liverpool, Ohio
Factory at Wellsville, O

Chicago Representative:
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SPECIAL PORCELAINS

THOMAS MADE porcelains not only promise but insure an unparalleled grade of insulation; *accuracy* that only skilled craftsmen accustomed to precision workmanship can produce; and *uniformity* that is the direct result of modern production facilities.

The Pioneer's experience befits him to offer the electrical manufacturer an exceptional service in the development of special porcelain parts, of most any size or shape no matter how intricate.

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LISBON, OHIO
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Established in 1873

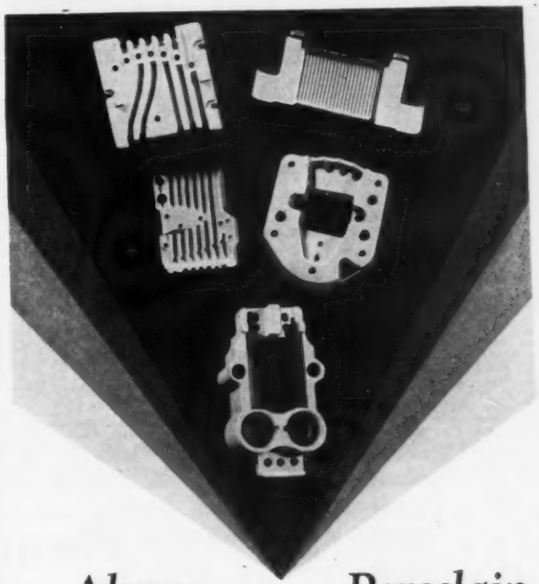
NEW YORK BOSTON CHICAGO

The Beacon

guiding you straight to porcelain satisfaction

Porcelain buying is not a gamble or a matter of guess work if you specify or insist upon getting STAR Quality. Star Porcelain is real quality and yet the price is as low as some inferior kinds. Let STAR Quality guide you.

The STAR PORCELAIN COMPANY
TRENTON NEW JERSEY



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Well formed - - - Strong
Accurate - - - Good appearance
Reasonable Prices

THE AKRON PORCELAIN CO.
Akron, Ohio
Formerly the Mogadore Insulator Company

SHELLS, Screw Socket—Continued
Bisdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Torrington Mfg. Co., 70 Franklin, Torrington, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., 800 S. Main, Waterbury, Conn. (Miniature.)

SHUNTS, Instruments. See Instruments, Laboratory Standard.

SIGN FLASHERS. See Flashers, Sign.

SIGN LETTER LENSES. See Lenses.

SILICA
Ottawa Silica Co., Ottawa, Ill. "Flint Shot."

SILK, Cloth Insulated. See Cloth & Paper.
Shades. See Shades, Fabric.
Tape. See Tape.
Thread. See Yarn, etc.

SILVER, Metal and Wire
Baker & Co., Inc., 54 Austin, Newark, N. J.
Handy & Harman, 57 William, New York, N. Y.
Wilco. See Wilson Co., H. A.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

SILVER SOLDER. See Solder, Silver.

SINE WAVE OSCILLATORS. See Instruments, Laboratory Standard.

SKINNERS WIRE. See Scrapers.

SLABS, Switchboard. See Asbestos Slabs; also Molded Insulation, Slate; Soapstone.

SLATE
For Switchboard Slabs and Barriers.
Davis Slate & Mfg. Co., 618 E. 40th, Chicago, Ill.
Electrical Specialties Corp., 50 Pearl, Boston, Mass.
Fair Haven Marble & Marbleized Slate Co., Fair Haven, Vt.
Penrhyn Slate Co., Hydeville, Vt.
Portland-Munson Slate Co., Portland, Me.
Structural Slate Co., Pen Argyl, Pa.

SLEEVE-BEARINGS. See Bearings and Bushings.

SLEEVING, Cotton. See Tape, Cotton.

SLOTTING FILES. See Files, Commutator Slotting.

SLOTTING MACHINES and TOOLS, Commutator
(Mica Undercutters).
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Binghamton Flexible Shaft Co., Binghamton, N. Y.
Burton & Rogers Co., 857 Boylston, Boston, Mass.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
General Electric Co., Schenectady, N. Y.
Hobart Bros. Co., Troy, Ohio.
Hullhorst Micro Tool Co., 3240 E. Monroe, Toledo, O.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill.
Imperial. See Martindale Elec. Co.
Martindale Electric Co., 1262 W. Fourth, Cleveland, Ohio.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Ransom & Randolph Co., Superior & Chestnut, Toledo, Ohio.
Simplex. See Weidenhoff, Joseph.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill.

SNAP SWITCHES. See Switches, Snap

SOAPSTONE
For Switchboard Slabs and Barriers.
Alberene Stone Co., 153 W. 23rd, New York, N. Y.
Lin-Stun. See Westinghouse.
Soapstone Products Co., 97 Warren, New York, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

SOCKET LININGS. See Linings, Socket

SOCKET SHELLS. See Shells, Screw Socket.

SOCKETS, Flashing. See Flashers, Sign.

SOCKET Chain and Attachments
Pull Chain, Chain Links, Chain Adjusters, Acorns, Extensions, Insulation Chain Splicers.
Abbott. See Harvey Hubbell, Inc.
American Brass Co., 25 Broadway, New York, N. Y. (Acorns.)
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Benjamin Electric Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bryant Electric Co., Bridgeport, Conn.
Duplex. See Warner Bros. Co.
Eade, John E., 104 Point, Providence, R. I. Links, Insulators.
Easylite. See Rittenhouse Co., A. E.
Economy. See Harvey Hubbell, Inc.
Flory, Wm. E., 38 W. 32nd, New York, N. Y. (Decorative Pull Chains.)
Gripper. See Wittenberg Bros.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. (Metal Pull Tassel.)
Hubbell, Inc., Harvey, Bridgeport, Conn. (Links and Acorns. Metal Pull Tassels.)
Paiste. See Hart & Hegeman Mfg. Co.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y. (Pull Chain Tassel.)
P. & S. See Pass & Seymour, Inc.
Rittenhouse Co., A. E., Honeoye Falls, N. Y. (Sole Selling Agent, Hatheway & Co., 16 Hudson, New York, N. Y.)
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Royal. See Sears, Henry D.
Scovil Mfg. Co., Waterbury, Conn. (Acorn.)
Sears, Henry D., 50 Boylston, Boston, Mass.
Weber. See Sears, Henry D.
Wittenberg Bros., 60 Shipman, Newark, N. J. Links, Insu-

SOCKET REDUCERS
Arrow Elec. Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Benjamin Electric Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Can-del-lite. See Sears, Henry D.
Eagle Electric Mfg. Co., 59 Hall, New York, N. Y.
Electric Co., 94 Allyn, Hartford, Conn.
General Electric Co., Merchandise Dept., Section W-233, Bridgeport, Conn.
Hart & Hegaman Div. of Arrow-Hart & Hegeman Elec. Co. Hartford, Conn.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Pass & Seymour, Solvay Sta., Syracuse, N. Y.
Propp Co., M., 524 Broadway, New York, N. Y.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Sears, Henry D., 50 Boylston, Boston, Mass.

SOCKETS, Radio. See Radio Receiver Parts.

SOCKETS AND RECEPTACLES, Lamp
Bases other than Standard (or Medium) are indicated as follows: Mogul, M; Candelabra (or Miniature), C.
Key ..... See K
Composition ..... See W
Metal Shell ..... See B
Porcelain ..... See A

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PORTLAND-MONSON SLATE CO. TRADE MARK PORTLAND, ME.
Quarriers of
Monson Slate
for Electrical Purposes, Natural Black, Oil Finish
Quarries: Monson, Maine
Office, Portland, Maine

Pull Chain ..... See P
Push Through ..... See T
Sign Receptacles ..... See A

A. B. C. See Leviton Mfg. Co.
Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J. ..... A
Ajax Elec. Specialty Co., 1926 Chestnut, St. Louis, Mo. ..... W
Alabax. See Arrow Elec. Co.
Appleton Electric Co., 1730 Wellington Ave., Chicago, Ill. ..... A
Armstrong & White, 9th and Liberty Ave., Pittsburgh, Pa. ..... A
Arrow Elec. Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. M C K T P B A
Arrogrip. See Arrow Elec. Co.
A. & W. See General Outdoor Adv. Co.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. ..... C . . . . P B .
Best. See United States Elec. Mfg. Corp.
Bryant Elec. Co., Bridgeport. ..... M C K T P B A
C-H. See Cutler-Hammer Mfg. Co.
Circle F Mfg. Co., Trenton, N. J. ..... M . . K T P B A
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. ..... .
Connecticut Elec. Mfg. Co., Bridgeport, Conn. ..... M . . K T . . B A
Crouse-Hinds Co., Syracuse, N. Y. ..... A W . . . . . .
Cutler-Hammer, Inc., 1237 St. Paul Ave., Milwaukee, Wis. ..... K T . . B A
Durex. See Wheeler Reflector Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y. ..... .
Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Ill. ..... P B . .
Far-Go Elec. Mfg. Co., 368 Broome, New York, N. Y. ..... C . . . . . .
Federal Electric Co., 8700 S. State, Chicago, Ill. ..... A
Flute. See Pass & Seymour.
Fluteller. See Pass & Seymour.
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. ..... M C . . . . . B . .
Gaynor Elec. Co., Bridgeport, Conn. ..... A
General Elec. Co., Section W-233, Merchandise Dept., Bridgeport, Conn.. M C K T P B A
Glow Elec. Co., 22 Queens, Long Island City, N. Y. ..... M . . . . . B . .
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. ..... M C K T P B A
Hoosick Falls Radio & Elec'l Parts Mfg. Co., Hoosick Falls, N. Y. ..... W . . . . . .
Hubbell, Inc., Harvey, Bridgeport, Conn. M C K T P B A
H. & H. See Hart & Hegeman.
I-D-A. See Watson Mfg. Co., J. E.
K-E Cleat Receptacle. See Kirkman.
Kirkman Engineering Co., 1 Dominick, New York. (Cleat Receptacle.) ..... .
Leader. See Leviton Mfg. Co.
Leiser & Co., W. A., 1607 Sansom, Philadelphia, Pa. ..... A
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y. ..... M C K . . P B A
Levolier. See McGill Mfg. Co.
Liberty Bell. See Hart & Hegeman.
Local-A-Catch. See Connecticut.
McGill Mfg. Co., Valparaiso, Ind. ..... P B A
Majestic Elec. Mfg. Co., 806 N. 12th, St. Louis. (Lamp Receptacle.) ..... A
Meteor Elec. Corp., 499 E. 70th, New York, N. Y. ..... K . . P . . .
Molded Socket Corp., Railroad, Pa. ..... K . . . . . .
Multi Elec'l Mfg. Co., 1840 W. 14th, Chicago, Ill. ..... A
Multilok. See Circle F Mfg. Co.
Newgard. See Multi Elec'l Mfg. Co.
New Wrinkle. See Bryant Elec.
Noark. See Colt's Patent Fire Arms.
One 4 All. See Propp Co., M.
P. & S. See Pass & Seymour.
Pass & Seymour, Solvay Station, Syracuse, N. Y. ..... M C K T P B A
Paulding, John I., New Bedford, Mass. ..... B A
Perkins. See Bryant Elec. Co.
Porcelain Products, Inc., Findlay, O. ..... A
Propp Co., M., 524 Broadway, New York, N. Y. ..... .
Quick Catch. See Hubbell, Inc.
Royal. See Sears, Henry D.

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Ryan Appliance Co., 117 Mulberry, Trenton, N. J. ..... W . . . . . A
Safti Soc. See Molded Socket Corp.
Sears, Henry D., 50 Boylston, Boston M C K T P B A
Security. See Circle F Mfg. Co.
Shurlock. See Pass & Seymour.
Siemen Co., Bridgeport, Conn. ..... .
Taplet Mfg. Co., 3709 Powelton Ave., Philadelphia, Pa. ..... A
Titan. See Bryant Elec. Co.
Trumbull Elec. Mfg. Co., Plainville, Conn. ..... A
Union Insul. Co., Parkersburg, W. Va. ..... .
United States Elec. Mfg. Corp., 223 W. 14th, New York, N. Y. ..... P . . B . . W
U. S. Electric Co., 311 Chambers St., Trenton, N. J. ..... A
Walco. See Leiser & Co., W. A.
Waterbury Button Co., Waterbury, Conn. ..... .
Watson Mfg. Co., J. E., 5506 N. Fifth, Philadelphia, Pa. (Concealed Fixture) ..... P B . .
Weber. See Sears, Henry D.
Wheeler Reflector Co., 275 Congress St., Boston, Mass. ..... P . . . .
Wiring Devices, Inc., 5 High, Trenton, N. J. ..... A
Wood Electric Co., C. D., 565 Broadway, New York. (Sign Receptacles.) ..... A
Woodwin. See Wood Elec. Co.
Wrinklet. See Bryant Elec. Co.

SOLDER, Aluminum
Allen Co., Inc., L. B., 6750 Bryn Mawr Ave., Chicago, Ill.
Aluminum Solder Corp. of America, 730 Fifth Ave., New York, N. Y.
Lenk Mfg. Co., 30 Merrimac, Boston, Mass.
Platt Bros. & Co., Waterbury, Conn.
Solderlume. See Aluminum Solder Corp. of America.
Union Smelting & Refining Co., Newark, N. J.
Usarco. See Union Smelting & Refining Co.

SOLDER, Bar and Wire
Eagle. See Hoyt Metal Co.
Genuine A. See Hoyt Metal Co.
Hoyt Metal Co., St. Louis, Mo.

SOLDER, Self-Fluxing
American Solder & Flux Co., 2910 N. 16th, Philadelphia.
Chicago Solder Co., 4210 Wrightwood Ave., Chicago, Ill.
Dutch-Boy. See National Lead Co.
Gardiner Metal Co., 1366 W. Lake, Chicago, Ill.
Kester. See Chicago Solder Co.
Lenk Mfg. Co., 32 Merrimac, Boston, Mass.
National Lead Co., 111 Broadway, New York, N. Y.
Solderall Co., 129 Sussex Ave., Newark, N. J.
Tinol. See American Solder & Flux Co.

SOLDER, Silver
Handy & Harman, 57 William, New York, N. Y.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

SOLENOIDS. See Coils, Finished.

SOLDERING
Compounds. See Soldering Compounds.
Irons. See Soldering Irons.
Machines. See Soldering Machines, Commutator
Tools. See Torches and Furnaces.

SOLDERING COMPOUNDS
Stick Paste, Flux Salts, Fluid.
Allen Co., Inc., L. B., 6750 Bryn Mawr Ave., Chicago, Ill. (Soldering, Stick Paste, Salts, Liquid Oil, Welder, Aluminum Flux, Fountain Brushes.)
American Solder & Flux Co., 2910 N. 16th, Philadelphia, Pa. Flux, Paste, Salts.
Ameo. See American Solder & Flux Co.
Anchor. See Garden City Laboratory.
Benson Co., Alex R., Hudson, N. Y. (Salts and Paste.)
Burnley Battery & Mfg. Co., North East, Pa. Paste and Stick.
Brunner Chemical Wks., 217 E. 3rd, Cincinnati, O.
Callahan & Co., Geo., 218 Front, New York. (Fluid.)
Central Stamping Co., 206 Broadway, New York, N. Y. Paste and Salts.
Challenge. See Highland Electro Chemical Co.
Conductalute. See Technical Products Co.
Crescent. See McGill Mfg. Co.
Diamond. See Burnley Battery & Mfg. Co.
Dielectric Mfg. Co., St. Louis, Mo.
Dunton Co., M. W., Providence, R. I.
Dutch-Brand. See Van Cleef Bros.
Eureka. See Grasselli Chemical Co.
Firth Radio Corp., 25 Beaver, New York, N. Y.
Fluxite. See Monarch Products Co.
Garden City Laboratory, 300 W. Adams, Chicago, Ill.
General Elec. Co., Section W-233, Merchandise Dept., Bridgeport, Conn. (Paste).
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Highland Electro Chemical Mfg. Co., Connellsville, Pa. (Paste, Stick, Salts.)
Incomparable. See Reade Mfg. Co.
Leveridge, Inc., Chas. W., 246 Fulton, New York, N. Y.
Luco. See Lukens Metal Co.
Lukens Metal Co., T. F., 1105 Fairmount Ave., Philadelphia, Pa.
McGill Mfg. Co., Valparaiso, Ind. Fluid.
Mitchell-Rand Mfg. Co., 19 Vesey, New York. (Paste.)
Monarch Products Co., Red Bank, N. J.
Neer Co., L. F., Butler, O. (Flux and Solution.)
Neutral. See Dielectric Mfg. Co.
New-Idea. See Hartwig Co., Wm. J.
Nokorode. See Dunton Co., M. W.
Oakwood. See Weaver Specialty Co.
Paragon Insulating Co., 5716 Euclid Ave., Cleveland, O.
Perfecto. See Firth Radio Corp.
Pfanstiehl Chemical Co., Waukegan, Ill. Paste, Salts, Sticks, Fluid, Oil, and Solid Sal Ammonica.
Queens. See Brunner Chemical Works.
Reade Mfg. Co., 133 Hoboken Ave., Jersey City, N. J. (Fluids, Salts, Paste).
Redens. See Reade Mfg. Co.
Red-Letter. See Ruby Chemical Co.
Rodale Mfg. Co., 200 Hudson, New York, N. Y. (Paste.)
Rotax Mfg. Co., 380 E. 133rd, New York, N. Y.
Ruby Chemical Co., Columbus, O.
Ruby Fluid. See Ruby Chemical Co.
Salbrick. See American Solder & Flux Co.
Silva-Wares, Inc., 134 W. 26th, New York, N. Y.
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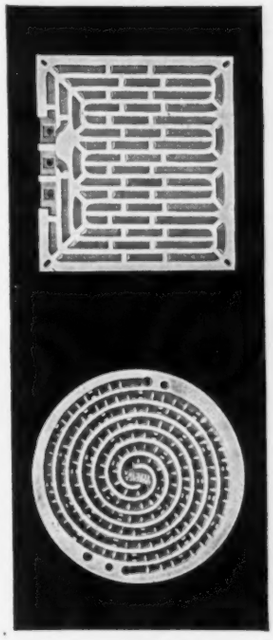

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Solderite, Inc., 22 Green, Newark, N. J.
Speco. See Pfanstiehl Chemical Co.
Standard. See Grasselli Chemical Co.
Star. See McGill Mfg. Co
Superior. See Highland Electro Chemical Co.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh, Pa. (Paste).
Tinol. See American Solder & Flux Co.
Van Cleef Bros., 7722 Woodlawn Ave., Chicago, Ill.
Weaver Specialty Co., 6344 Aurelia, Pittsburgh, Pa.
Yager's. See Benson Co., Alex R.
Yankee. See Loveridge, Inc., Chas. W.

SOLDERING IRONS
Acme Elec. Heating Co., Dept R, 1217 Washington, Boston.
Adroit. See Adrola Corp.
Adrola Corp., Port Jefferson, N. Y.
American Beauty. See American Elecl. Heater Co.
Americal Elecl. Heater Co., Detroit, Mich.
Beardsley & Wolcott Mfg. Co., Waterbury, Conn.
Beckwith Machine Co., Ravenna, Ohio.
Betsy Ross. See Central Flatiron Mfg. Co.
Brach Mfg. Corp., L. S., Newark, N. J.
Burnley Battery & Mfg. Co., North East, Pa.
Central Flatiron Mfg. Co., Johnson City, N. Y.
Chapman Machine Co., Terryville, Conn.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Davis Specialty Works, East Gary, Ind.
Dominion Elec'l Mfg. Co., 712 Ontario Ave., N., Minneapolis.
Dover Mfg. Co., Dover, O.
Drake Elec. Wks., 3943 Lincoln Ave., Chicago, Ill.
Edison Elec. Appliance Co., 5600 W. Taylor, Chicago, Ill.
Electrahot Mfg. Co., 525 S. 4th, Minneapolis, Minn.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland. (Transformer Soldering Outfit.)
Electric Soldering Iron Co., Inc., 135 W. 17th, New York.
Electrical Products Mfg. Co., Providence, R. I.
Enco. See Electrical Necessities Corp.
Esico. See Electric Soldering Iron Co.
Everhot. See Swartzbaugh Mfg. Co.
Ever-Ready. See Gold Seal Elec. Co.
General Electric Co., Schenectady, N. Y.
Gold Seal Elecl. Co. of Ohio, Inc., 250 Park Ave., New York, N. Y.
Home. See Majestic Elec. Appliance Co.
Illinois Stamping & Mfg. Co., 220 N. Jefferson, Chicago, Ill.
Industrial. See Permway Mfg. Co.
Jiffy. See Koch & Co., Paul W.
Junior. See Drake Elec. Wks.
King. See Electric Heat Control Co.
Koch Co., Paul W., 23 S. Wells, Chicago. (Solder Dipper)
Landers, Frary & Clark, New Britain, Conn.
Lenk Mfg. Co., 30 Merrimac, Boston, Mass.
Lotan. See Simplex Flux & Solder Co. of America.
Lucifer. See Jones Point Tool & Elec. Co.
Majestic Electric Appliance Co., San Francisco, Cal.
Manning-Bowman & Co., Meriden, Conn.
Mechanics. See Drake Elec. Wks.
Moto-Ray Mfg. Co., 169 Massachusetts Ave., Boston, Mass
National Specialties Co., Howell & Tyler Sts., Fort Wayne, Ind.
Northern Elec. Co., 2833 N. Western Ave., Chicago, Ill.
Queen Quality. See Watlow Elec. Mfg. Co.
Quick-Hot. See Moto-Ray Mfg. Co.
Radio See Drake Elec. Wks.
Regular. See National Specialties Co.
Reliance. See Landers, Frary & Clark.
Samson Cutlery Co., 8 Jones St., Rochester, N. Y.
Security Elec. Mfg. Co., 2633 Canton, Chicago, Ill.
Silver King. See Illinois Stamping & Mfg. Co.
Simplex Flux & Solder Co. of America, 1965 E. 66th, Cleveland, O.
Superior Elec. Products Corp., 1300 S. 13th, St. Louis, Mo.
Swartzbaugh Mfg. Co., 1501 W. Bancroft, Toledo, O.
Torrid. See Beardsley & Wolcott Mfg. Co.
Trent, Harold E., 295 N. Lawrence, Philadelphia, Pa.
Varick Elec. Mfg. Co., 28 E. 21st St., New York, N. Y.
Vulcan Elec. Heating Co., 225 Varick, New York, N. Y.
Waage Elec. Co., 5100 W. Ravenswood Ave., Chicago, Ill.
Ward Mfg. Co., 937 Wellington Ave., Chicago, Ill.
Watlow Elec. Mfg. Co., 1320 N. 23rd, St. Louis, Mo.
Wellmade Elec. Co., Torrington, Conn.

SOLDERING MACHINES, Commutator
(For production soldering of small commutators).
Allatonce. See Chapman Electric Works, P. E.
Chapman Electric Works, P. E., 1820 Chouteau Ave., St Louis, Mo.
SOLENOIDS. See Coils
SOLVENTS & REDUCERS, VARNISH. See Paint, Varnish, Lacquer.
SPAGHETTI. See Tubing, Varnished Fabric.
SPEED CHANGING UNITS. See Gears (Speed Changing Units).
SPEED INDICATORS. See Tachometers.
SPOOLING MACHINES, WIRE. See Wire Manufacturing Machines.

SPRAYING OUTFITS
Airway. See Binks Spray Equip. Co.
Babco. See Simons Paint Spray Brush Co.
Beach Air Brush Co., Willard C., Harrison, N. J.
Binks Spray Equipment Co., 3120 Carroll Ave., Chicago, Ill
De Vilbiss Mfg. Co., 3750 Detroit Ave., Toledo, Ohio.
Eclipse Air Brush Co., 79 Orange, Newark, N. J.
Electric Sprayit Co., 320 E. Colfax Ave., South Bend, Ind.
Eureka Sprayers, Inc., 87-28 130th, Long Island City, N. Y.
Ideal Air Brush Mfg. Co., 203 Lafayette, New York, N. Y.
Kellogg Mfg. Co., 97 Humboldt, Rochester, N. Y.
Koch Bros. Mfg. Co., 2339 Nelson, Chicago, Ill.
K B. See Koch Bros. Mfg. Co.
Metal Specialties Mfg. Co., 338 N. Kedzie Ave., Chicago.
Macleod Co., 2232 Bogen, Cincinnati, O.
Paasche Air Brush Co., 1911 Diversey Parkway, Chicago, Ill
Pioneer Air Compressor Co., 176 Grand, New York, N. Y.
Presto. See Metal Specialties Mfg. Co.
Simons Paint Spray Brush Co., 17 Maryland Ave., Dayton, O.
Simplex Spray Equipment Co., 552 W. Lake, Chicago, Ill.
Sprayit. See Electric Sprayit Co.
Wold Air Brush Mfg. Co., 2173 N. California Ave., Chicago, Ill.
SPREADERS, COIL & LOOP. See Winding Machines, Armature & Field Coil.

SPRING MAKING MACHINES
Sleeper & Hartley, Inc., Worcester, Mass.

SPRINGS,
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Barnes-Gibson-Raymond, Inc., 6400 Miller Ave., Detroit, Mich.
Cary Spring Works, Inc., 240 W. 20th St., New York, N. Y.
Chapin Co., Chas. E., 227 Fulton, New York, N. Y.
Cleveland Wire Spring Co., Cleveland, O.
Cook Spring Co., Ann Arbor, Mich.
Cuyahoga Spring Co., Berea Rd., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Eureka Tinware Mfg. Co., 135 W. 20th, New York, N. Y.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y

Gibson Co., Wm. D., 1800 Clybourn Ave., Chicago, Ill.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hunter Pressed Steel Co., Landadale, Pa.
Lee Spring Co., 34 Main, Brooklyn, N. Y.
Miller & Van Winkle, Inc., 18 Bridge, Brooklyn, N. Y.
Newcomb Spring Corp., 234 40th, Brooklyn, N. Y.
Peck Spring Co., Plainville, Conn.
Peterson Spring Co., 1660 Beard Ave., Detroit, Mich.
Rapid Spring Co., 222 Second Ave., Pittsburgh, Pa.
Raymond Mfg. Co., Corry, Pa.
Standard Spring and Manufacturing Co., 236-42nd St., Brooklyn, N. Y.
Steinen & Co., 297 Washington, Newark, N. J.
Wallace Barnes Co., Bristol, Conn.
Young Industries, Inc., L. A., Detroit, Mich.
STAMPED BOXES. See Cabinets, Sheet Steel.
STAMPINGS, Fibre. See Fibre.
Sheet Metal. See Fixture Fittings.
Sheet Steel. See Stampings, Sheet Steel.
Small. See Stampings, Small.

STAMPINGS, Sheet Steel
Heavy Stamping and Drawing.
Acklin Stamping Co., 1925 Nebraska, Toledo, O.
American Stamping Co., 978 E. 64th, Cleveland, O.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bossert Corp., Utica, N. Y.
Faries Mfg. Co., Decatur, Ill.
Geuder, Paeschke & Frey, St. Paul & 15th, Milwaukee.
Hubbard & Co., Pittsburgh, Pa.
Janney, Steinmetz & Co., 1421 Chestnut St., Philadelphia.
Massachusetts Machine Shop, Inc., Boston, Mass.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
Metropolitan Devices Corp., 1250 Atlantic Ave., Brooklyn.
Mullins Mfg. Corp., Washing Machine Division, Salem, Ohio. (Vitreous Enameled)
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.
Truscon Steel Co., Youngstown, O.

STAMPINGS, Small
Small Stamped Metal Parts for Electrical Devices.
Advance Tool & Die Casting Co., 1654 Holton, Milwaukee.
Aerial Machine & Tool Co., 79 Grand, New York, N. Y.
American Emblem Co., Utica, N. Y.
American Radio Hardware Co., 135 Grand, New York, N. Y.
American Stamping Co., 978 E. 64th, Cleveland, O.
Arrow Automatic Products Corp., 37 Vestry, New York, N. Y.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Bull Dog Electric Products Co., Detroit, Mich.
Chase Brass & Copper Co., Waterbury, Conn.
Clarke Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Eureka Tool & Machine Co., Newark, N. J.
Faries Mfg. Co., Decatur, Ill.
Geuder, Paeschke & Frey, St. Paul & 15th, Milwaukee.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Gray Bros. Co., Plano, Ill.
Hubbard Spring Co., M. O., Pontiac, Mich.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Krischer's Mfg. Co., 255 Calyer, Brooklyn, N. Y.
Lansing Stamping Co., Lansing, Mich.
Lenz Metal Stamping Wks., J., 199 Franklin, New York.
Massachusetts Machine Shop, Inc., Boston, Mass.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
Mechanics Tool & Stamping Co., 7 Summer, Worcester, Mass.
Mutual. See Bull Dog Elec. Products Co.
Patton-MacGuyer Co., Providence, R. I.
Paul & Beekman Mfg. Co., 1734 N. Fifth, Philadelphia, Pa.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Precision Metal Workers, 3100 Carroll Ave., Chicago, Ill.
Premax Products, Inc., Niagara Falls, N. Y.
Quadrigs Mfg. Co., 213 W. Grand Ave., Chicago, Ill.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Signal Elec. Mfg. Co., Menominee, Mich.
Steinen & Co., 297 Washington, Newark, N. J.
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.
United Stamping & Mfg. Co., Cleveland, Ohio.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., Waterbury, Conn.
Waterbury Mfg. Co., 236 Grand, Waterbury, Conn.
Waterbury Metal Wares Co., Waterbury, Conn.
Zierick Machine Wks., F. R., 63 E. 131st St., New York, N. Y.

STANDS, Armature
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17 & Cambria Sts., Philadelphia, Pa.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Ridlon Company, Frank, Boston, Mass.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill.
STARTERS, Motor. See Controllers, Motor; Switches, Remote Control; Switches, Knife; Safety; Switches, Snap (Heavy Duty).
STEATITE. See Cores, Resistance Coil.
STEEL CASTINGS. See Castings, Steel.

STEEL for Electric Appliances
Elyria Iron & Steel Co., Elyria, O.
Ryerson & Son, Jos., 2558 W. 16th, Chicago, Ill.

STEEL, Magnet
Ajax Electrothermic Corp., Trenton, N. J.
Hercules Elec. Steel Corp., 145 Lafayette St., New York.
Indiana Steel Products Co., 4545 S. Western Ave., Chicago.
Ludlum Steel Co., Watervliet, N. Y.

STEEL SHEETS
Agathon. See Central Alloy Steel Corp.
Allegheny Steel Co., Brackenridge, Pa.
American Rolling Mill Co., Middleton, Ohio.
American Sheet & Tin Plate Co., Frick Bldg., Pittsburgh.
Armeelec. See Empire Steel Corp.
Central Alloy Steel Corp., Massillon, O.
Cyclops Steel Co., Titusville, Pa.
Dynelec. See Empire Steel Corp.
Empire Steel Corp., Mansfield, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Manelec. See Empire Steel Corp.
Metelec. See Empire Steel Corp.
Newport Rolling Mill Co., Newport, Ky.
Polelec. See Empire Steel Corp.
Republic Iron & Steel Co., 335 Market, Youngstown, O.
Tranelec. See Empire Steel Corp.
Unilov. See Universal Steel Co.

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Springs of every description. Flexible Shafts, Metal and Wire Specialties. Write for prices.
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Universal Steel Co., Bridgeville, Pa.
Wheeling Steel Corp., Wheeling, W. Va.
STEEL, STRIP. See Strip Steel.

STOCKS, Dies and Reamers
Hall-Will, Inc., Erie, Pa.
Red-E-Hall. See Hall-Will, Inc.
Toledo Pipe Threading Machine Co., 1445 Summit, Toledo, O.

STONES, Commutator
Acme. See Green Equipment Corp.
Caro. See Electric Service Supplies Co.
Cleveland Stone Co., Union Trust Bldg., Cleveland, O.
Co-operative Utilities Co., 1503 Columbia Ave., Philadelphia, Pa.
Diamond Dee. See Co-operative Utilities Co.
Electric Service Supplies Co., 17th and Cambria, Philadelphia, Pa.
Green Equipment Corp., Monadnock Block, Chicago, Ill.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill.
Imperial. See Martindale Electric Co.
Lombard & Co., Somerville, Mass.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.

STOOLS, Factory; Steel
Angle Steel Stool Co., Plainwell, Mich.
Chicago Wire Chair Co., 613 N. La Salle, Chicago, Ill.
Royal Metal Mfg. Co., 1136 South Michigan Ave., Chicago, Ill.

STORAGE
Battery Plates. See Plates, Storage Battery.
Battery, Separators. See Separators.
Tools. See Tools, Storage Battery.
STRAINING MACHINES, INSULATION. See Wire Manufacturing Machines.

STRAIGHTENERS, Armature Shaft
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
STRANDING MACHINES. See Wire Manufacturing Machines.

STRIP STEEl
(Hot and Cold Roll).
Acme Steel Co., 2840 Archer Ave., Chicago, Ill. (Hot & Cold).
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. (Cold).
American Tube & Stamping Plant (Stanley Wks.) Bridgeport, Conn. (Hot & Cold.)
Athenia Steel Co., 135 William, New York, N. Y. (Cold.)
Barnes Co., Wallace, Bristol, Conn. (Hot.)
Central Alloy Steel Corp., Massillon, O. (Hot.)
Griffin Mfg. Co., Erie, Pa. (Hot & Cold.)
Laclede Steel Co., 8th & Olive Sts., St. Louis, Mo. (Hot.)
Latrobe Electric Steel Co., Latrobe, Pa. (Hot & Cold.)
Republic Iron & Steel Co., 335 Market, Youngstown, O.
Sharon Steel Hoop Co., Sharon, Pa. (Hot.)
Stanley Wks., New Britain, Conn. (Hot & Cold.)
Steel and Tubes, Inc., Cleveland, O. (Hot & Cold.)
Superior Steel Corp., Union Trust Bldg., Pittsburgh, Pa. (Hot & Cold.)
West Leechburg Steel Co., Farmers Bank Bldg., Pittsburgh, Pa. (Hot & Cold.)

STRIPPERS, Wire
Acme. See A. Laubscher.
Artos Engineering Co., 69 Wisconsin, Milwaukee, Wis. (Cutting, Stripping and Measuring).
Austin Co., M. B., 108 S. Desplaines, Chicago, Ill.
Dicke Tool Co., Downers Grove, Ill.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
E-Z. See Pyramid Products Co.
F. F. See France Mfg. Co.
Foley Saw Tool Co., 655 Foley Bldg., 9 Main, N. E., Minneapolis, Minn. (Bench Type Wire Stripper.)
France Mfg. Co., 10325 Berea Rd., Cleveland. (Motor Driven.)
Goehst. See Klein & Sons.
Hartman. See Service Sales & Mfg. Co.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill.
Ives Mfg. Co., Meriden, Conn.
Klein & Sons, Mathias, Chicago, Ill.
Laubscher, A., 77 Fort Pleasant Ave., Springfield, Mass.
Perfection. See Weber Machine Corp.
Service Sales & Mfg. Co., 17005 Melgrave Ave., Cleveland, Ohio.
Speedcraft. See Wire Stripper Co.
Weber Machine Corp., 33 S. Water, Rochester, N. Y.
Wire Stripper Co., 1508 Erie Bldg., Cleveland, O.
Zierick Machine Wks., F. R., 6 Howard, New York City. (Motor Driven Stripper & Twister).
SWITCHBOARD INSTRUMENTS. See Instruments, Portable and Switchboard.

SWITCHBOARD OPALS. See Lenses.
SWITCHBOARDS, SLABS AND BARRIERS
See Asbestos Slabs; Molded Insulation: Slate; Soapstone.

SWITCH (Switches)
Arms. See Posts, Binding.
"Across the Line" Type. See Controllers, Motor.
Baby Knife. See Switches, Battery.
Battery. See Switches, Battery.
Canopy. See Switches, Snap.
Clock Operated. See Switches, Time.
Feed Through. See Switches, Snap.
Fixture. See Switches, Snap.
Float. See Switches, Tank.
Flush. See Switches, Snap.
Handles. See Handles, Wood
Knife, Baby. See Switches, Battery & Baby Knife.
Lever Radio. See Radio Mounting.
Lever. See Switches, Snap, Lever.
Limit. See Controllers, Motor.
Mercury. See Switches, Mercury
Motor Starting, Magnetic Type. See Controllers.
Motor Starting, Non-Magnetic. See Switches, Motor Starting.
Pendant. See Switches, Snap.
Pressure Regulating. See Controllers.
Push Button, Snap. See Switches, Snap.
Push Button, Motor Starting. See Switches, Remote Control.
Radio Receiver. See Radio Mountings.
Range. See Switches Snap; Heavy Duty
Remote Control. See Switches, Remote Control.
Reversing. See Controllers.
Rotary. See Switches, Snap.
Safety. See Switches, Knife.
Snap. See Switches, Snap.
Starter Type. See Controllers.
Storage Battery. See Switches, Storage Battery.
Surface. See Switches, Snap.
Tank. See Switches, Tank.
Time. See Switches, Time.
Toggle. See Switches, Snap.
Tumbler. See Switches, Snap.

SWITCHES, Battery and Baby Knife
Cut-Out Switches.
Anti-Wood. See Kell & Son, Francis.
Bridgeport Switch Co., 209 Center, Bridgeport, Conn.

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UNIVERSAL and Induction type small fractional horsepower motors that are adaptable to many devices that require the use of small and dependable motors—2½″ x 2½″ and larger frame size.

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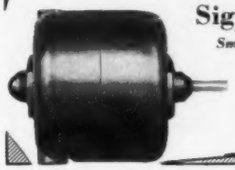

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D.C. Compound Wound
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All in interchangeable frames.

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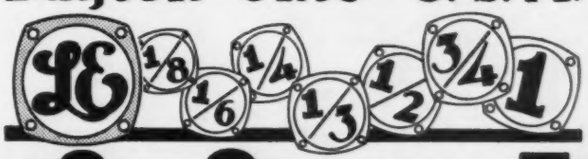

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SWITCHES, Battery and Baby Knife—Continued
Bryant Electric Co., Bridgeport, Conn.
Chapman. See Frank W. Morse & Co.
Chicago Elec. Mfg. Co., 2801 S. Halsted, Chicago, Ill.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Circle T. See Trumbull Elec. Mfg. Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Crown. See Edwards & Co., Inc.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Diamond H. See Hart Mfg. Co.
Edwards & Co., Inc., 140th & Exterior, New York, N. Y.
Electrad, Inc., 428 Broadway, New York, N. Y.
Eureka. See Frank W. Morse & Co.
Fahnestock Elec. Co., cor. East Ave. and 8th, Long Island City, N. Y.
Handy. See Chicago Elec. Mfg. Co.
H. & H. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co. Hartford, Conn. (Push Button.)
Harwood. See Frank W. Morse & Co.
Heinemann Elec. Co., Philadelphia, Pa.
Jost. See Frank W. Morse & Co.
Kappa. See Trumbull Elec. Mfg. Co.
Keil & Son, Francis, 401 E. 163rd, New York, N. Y.
Kendrick & Davis Co., Lebanon, N. H.
Keystone. See Frank W. Morse & Co.
King Mfg. Co., B. C., 302 Park Ave., Brooklyn, N. Y.
Knox Porcelain Corp., Knoxville, Tenn.
K-P-F Elec. Co., 855 Howard St., San Francisco, Cal.
Kurz & Root, Appleton, Wis.
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y.
Lyons Mfg. Co. (Mt. Carmel), New Haven, Conn.
Majestic Elec. Mfg. Co., 80 N. 12th St., St. Louis, Mo.
Manhattan Elecl. Supply Co., 190 Sixth Ave., New York, N. Y.
Morse Co., Frank W., Boston, Mass.
Partrick & Wilkins Co., Philadelphia, Pa.
Porcelain Products, Inc., Findlay, Ohio.
Powerlite Switchboard Mfg. Co., 4149 E. 79th, Cleveland, O.
Pulirite. See Frank W. Morse & Co.
Reliabl Electric Co., 3145 Carroll Ave., Chicago, Ill.
Samson Electric Co., Canton, Mass.
Spero Elec. Mfg. Co., E. 33rd and Woodland Ave., Cleveland.
Sta-Rite. See Frank W. Morse & Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
Wood Elec. Co., C. D., 565 Broadway, New York, N. Y.

SWITCHES, Mercury

(For Temperature Control Apparatus.)
Con-Tac-Tor. See Time-O-Stat Controls Co.
Cooper Hewitt Electric Co., 419 Eighth, Hoboken, N. J.
Cramblet Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
General Kontroler Co., 200 E. First, Dayton, O.
Kon-nec-tor. See Cooper Hewitt Elec. Co.
Kontax. See General Kontroler Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill.
Safety Regulator Co., 529 S. Mathews, Los Angeles, Cal.
Time-O-Stat Controls Co., Elkhart, Ind.

SWITCHES, Motor Starting

Accesible. See Trumbull-Vanderpoel Elec. Mfg. Co.
Aces. See Colt's Patent Fire Arms Mfg. Co.
Adam Elec. Co., Frank, St. Louis, Mo.
Aurora Steel Products Co., Aurora, Ill.
Barber Elec. Mfg. Co., North Attleboro, Mass.
Bull Dog Electric Products Co., Detroit, Mich.
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Columbia Metal Box Co., 228 E. 144th, New York, N. Y.
Crouse-Hinds Co., Syracuse, N. Y.
E. W. See Trumbull Elec. Mfg. Co.
FA. See Adam Elec. Co., Frank.
F. A. Triumph. See Metropolitan Elec. Mfg. Co.
Federal Steel Products Co., 2 Ave. L., Newark, N. J.
Large-Dail Mfg. Co., 606 Cherry, Philadelphia, Pa.
Leonard Elec. Mfg. Co., 2907 Perkins Ave., Cleveland, O.
Lundy Co., E. A., Fulton Bldg., Pittsburgh.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Major. See Adam Elec. Co., Frank.
Mason. See Trumbull-Vanderpoel Elec. Mfg. Co.
Metropolitan Device Corp., 1250 Atlantic Ave., Brooklyn, N. Y.
Metropolitan Elec. Mfg. Co., Blvd. at 14th, Long Island City, N. Y.
Murray. See Metropolitan Device Corp.
Mutual. See Bull Dog Elec. Products Co.
Naro. See Metropolitan Elec. Mfg. Co.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Nublade. See Colt's Patent Fire Arms Mfg. Co.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Robbins & Myers, Inc., Springfield, O.
Safe-Lock. See Trumbull-Vanderpoel Elec. Mfg. Co.
Safelock. See Westinghouse Elec. & Mfg. Co.
Schmuckler & Sons, 2232 N. 28th, Philadelphia, Pa.
Square D Co., Detroit, Mich.
S. S. See Wadsworth Elec. Mfg. Co.
Tanner & Co., Wm. F., 511 Sharp, Baltimore, Md.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
T. V. Safelock. See Trumbull-Vanderpoel Elec.
Unisafti. See Metropolitan Device Corp.
Unit-Versal. See Bull Dog Elec. Products Co.
V. V. Fittings Co., 711 Cherry, Philadelphia, Pa.
Wadsworth Elec. Mfg. Co., Covington, Ky.
Westinghouse Elec. & Mfg. Co., Mansfield, O.

SWITCHES, Remote Control

Push Button, Magnetically Operated.
Adam Electric Co., Frank, St. Louis, Mo.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Automatic Switch Co., 154 Grand, New York, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Cramer & Co., R. W., 136 Liberty, New York, N. Y.
Cutler-Hammer, Inc., 1287 St. Paul Ave., Milwaukee.
Diamond H. See Hart Mfg. Co.
Dunco. See Struthers Dunn, Inc.
General Electric Co., Section W-233, Merchandise Dept., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
H. P. See Palmer Elec. & Mfg. Co.
Industrial Controller Co., Milwaukee, Wis.
Kato Engr. Co., Mankato, Minn.
Major, F. A., System. See Adam Elec. Co.
Monitor Controller Co., 51 S. Gay, Baltimore, Md.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Precise Mfg. Co., 254 Mill, Rochester, N. Y.
Protectoswitch. See Precise Mfg. Co.
R. C. O. C. See South Bend Current Controller Co.
Sauter. See Cramer & Co., R. W.
Signal Engineering & Mfg. Co., 146 W. 14th, New York.
South Bend Current Controller Co., South Bend, Ind.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Takamine Corp., 208 Rawson St., Long Island City, N. Y.
Teeple Co., L. R., 540 E. Ninth, Portland, Ore.
Triplock. See Monitor Controller Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

SWITCHES, Snap

KEY

Feed Through ..... See p
Fixture (Canopy, Candelabra and Key Arm) ..... See F
Flush ..... See f
Lever, Toggle, Tumbler ..... See L
Pendant ..... See p
Push Button ..... See P
Rotary ..... See R
Surface ..... See s

See Also Switches, Snap; Heavy Duty.
Adam Electric Co., Frank, St. Louis, Mo. f . . . . . .
Anylite Elec. Co., Ft. Wayne, Ind. . . . . L . .
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. . . f sp P R L F
Arrow Head. See Arrow Elec.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. . . . . f p P . . . F
Best. See United States Elec. Mfg. Corp.
Brascolite. See Guth & Co., Edwin.
Bremer Elec. Mfg. Co., 139 N. 7th, Philadelphia, Pa. . . . . f . . . . . .
Bridgeport Switch Co., 209 Center, Bridgeport, Conn. . . . . L F
Bryant Elec. Co., Bridgeport, Conn. . . . . f sp P R L F
B. S. Co. See Bridgeport Switch Co.
Carling Tool & Machine Co., 32 Union Place, Hartford, Conn. . . . . F
Circle F. Mfg. Co., Trenton, N. J. . . . . f . . P . . L F
Circle T. See Trumbull Elec. Mfg. Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn. . . . . p P R L F
Crouse-Hinds Co., Syracuse, N. Y. . . . . L . .
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis. . . . . P . . . . L . .
Diamond H. See Hart Mfg. Co.
Dugle. See Bryant Elec. Co.
Economy Fuse Mfg. Co., 2717 Greenview Ave., Chicago, Ill. . . . . F
Gaynor Elec. Co., Bridgeport, Conn. . . . . f . . . . . L . .
General Elec. Co., Section W-233, Merchandise Dept., Bridgeport, Conn. . . . f sp P R L F
Glo-Guide. See Bryant Elec. Co.
Gold Star Push Switch. See Hart & Hegeman.
Guth & Co., Edwin, 2615 Washington Ave., St. Louis, Mo. . . . . F
Hart Mfg. Co., Hartford, Conn. . . . . f sp P R L . .
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co. (Door Bolt Control) f sp P R L F
Hart. See Hart & Hegeman.
H. & H. See Hart & Hegeman Mfg. Co.
Hubbell, Inc., Harvey, Bridgeport, Conn. . . . sp . . . . L F
Jost. See Morse, Frank W.
Keil & Son, Francis, 401 E. 163rd, New York, N. Y. . . . . f . . P . . . . .
Leviton Mfg. Co., 226 Newell, Brooklyn . . . . . F
Levoller. See McGill Mfg. Co.
McGill Mfg. Co., Valparaiso, Ind. . . . . f . . . . . L F
Marks Products Co., 80 N. Ninth, Brooklyn, N. Y. . . . . L F
Metropolitan Elec. Mfg. Co. Blvd at 14th St., Long Island City, N. Y. . . . . s . . R . . .
Morse Co., Frank W., 291 Congress, Boston . . . P . . . . .
National. See Standard Elec. Mfg. Co.
New England. See Paulding, John L.
Nutmeg. See Hubbell, Harvey, Inc.
Operite. See Morse Co., Frank W.
Pass & Seymour, Solvay Sts., Syracuse, N. Y. . . . . f sp P . . L F
Paulding, John I, New Bedford, Mass. . . . f s P . . . . .
Pen Tap. See Beaver Mfg. Co.
Perkins. See Bryant Elec. Co.
Pilot Electric Mfg. Co., 323 Berry, Brooklyn, N. Y. . . . . L . .
Pilotoggle. See Pilot Elec. Mfg. Co.
Pulirite. See Morse, Frank W.
Rodale Mfg. Co., 200 Hudson, New York p . . . . . .
Sears, Henry D., 80 Boylston, Boston . . f sp P R L F
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa. . . . . P . . . . .
Snapit. See Marks Products Co.
Spartan. See Bryant Elec. Co.
Standard Elec. Mfg. Co., 941 Wrightwood Ave., Chicago, Ill. . . . . f s P R L . .
Trigle. See Bryant Elec. Co.
Trumbull Elec. Mfg. Co., Plainville, Conn. f s P R L . .
Tumbolier. See Hart & Hegeman.
Twi-Lite. See McGill Mfg. Co.
United States Elec. Mfg. Corp., 222 W. 114th, New York, N. Y. . . . . f . . . . . .
Victor. See Keil & Son, Francis.
Weber. See Sears, Henry D.
Workrite. See Morse, Frank W.
Yankee. See Bryant Elec. Co.

SWITCHES, Snap; Heavy Duty

Heavy duty rotary snap switches for Electric Range and Small Motor Control.
Arrow Elec. Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Bryant Electric Co., Bridgeport, Conn.
Diamond H. See Hart Mfg. Co.
Domestic Electric Co., 7723 St. Clair Ave., Cleveland, Ohio.
General Electric Co., Section W-233, Merchandise Dept., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.

SWITCHES, Storage Battery; Automatic Disconnecting

Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Penn Electric Machine Co., Des Moines, Ia.
Radioloc. See Cutler-Hammer Mfg. Co.

SWITCHES, Tank

Blackburn-Smith Corp., 25 W. 45th, New York, N. Y.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Electrical Repair Co., 240 W. 25th, New York, N. Y.
General Electric Co., Schenectady, N. Y.
Industrial Controller Co., S. Pierce & Hanover Sts., Milwaukee, Wis.
Leader-Trahern Products Co., Decatur, Ill.
Ostrander Elec. Wks., W. R., 911 Atlantic Ave., Brooklyn.
Penn Elec. Switch Co., 20th & Walnut, Des Moines, Ia.
Sundh Elec. Co., 209 Parkhurst, Newark, N. J.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

SWITCHES, Time (Automatic Clock Operated Switches)

Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Astrachron. See Gem Engineering Co.
Automatic Elec. Heater Co., 1505 Race, Philadelphia, Pa.
Automatic Elec. Mfg. Co., Mankato, Minn.
Automatic Lighting Co., 831 Greenmount Ave., Baltimore.
Automatic Sprinkler Corp. of America, 910 B. of L. E. Bank Bldg., Cleveland, Ohio.
Automatic Timer Co., 1841 Euclid Ave., Cleveland, O.
Berry, A. Hall, 73 Murray, New York, N. Y.
Brown & Pengilly, Inc., 1384 Folsom, San Francisco, Cal.

Buckeye Time Switches, Inc., 1557 St. Clair Ave., Cleveland, O.
Cackle. See Berry A. Hall.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Clark. See Automatic Heater Co.
Con-tac-tor. See Absolute Con-tac-tor Corp.
Cramer & Co., R. W., 136 Liberty, New York, N. Y.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Frisch, Walter P., 104 Linden, Rochester, N. Y.
Gem Engineering Co., Hempstead, N. Y.
General Electric Co., Schenectady, N. Y.
Go-N-Set. See G. & S. Research Lab.
G. & S. Research Laboratory, 1269 Cochran Ave., Los Angeles, Cal.
Hart Mfg. Co., Hartford, Conn.
Hartford. See Berry A. Hall.
Horni Signal Mfg. Co., 290 Hudson, New York, N. Y.
Jewel. See Time Switch Sales & Service.
Knowles, W. E., 2869 Broadway, Oakland, Cal.
Kwikset. See Thompson Clock Co.
Lamp-Lighter. See Robbins & Myers Co.
Liberty Bell Mfg. Co., Minerva, Ohio.
Mercury Time Switch Co., Marine City, Mich.
Northwestern Clock Co., Omaha, Neb.
Ohio Time Switch Co., 1439 St. Clair Ave., Cleveland.
Paragon Elec. Co., 409 S. Dearborn, Chicago, Ill.
Racine. See Reliance Automatic Ltg. Co.
Radio Owl, 2269 E. 51st, Los Angeles, Cal.
Radio Switchman. See R-Y Mfg. Co.
Reliance Automatic Ltg. Co., 1925 Meade, Racine, Wis.
Research Mfg. Laboratory, 1269 Cochran Ave., Los Angeles.
Robbins & Myers Co., Springfield, O.
Ross Safety Switch Corp., 1 E. 42nd, New York, N. Y.
R-Y Mfg. Co., Marshfield, Mass.
Sauter. See Cramer & Co.
States Co., Hartford, Conn.
Thompson Clock Co., H. C., Bristol, Conn.
Time Switch Sales & Service, 1841 Euclid Ave., Cleveland, O.
Tork Clocks, Inc., 12 E. 41st, New York, N. Y.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

TACHOMETERS

Speed Indicators, Speedometers, Revolution Counters.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Brown Instrument Co., Wayne & Windrim, Philadelphia.
Comet Elec. Co., 47 Union Trust Bldg., Indianapolis, Ind.
Durant Mfg. Co., 655 Buffum, Milwaukee, Wis.
Electric Tachometer Corp., Spring Garden & Broad St., Philadelphia, Pa.
Holtzer-Cabot Elec. Co., Boston, Mass.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Productimeter. See Durant Mfg. Co.
Standco. See Sticht & Co.
Sticht & Co., H. H., 13 Park Row, New York, N. Y.
Veeder Mfg. Co., 14 Sargeant, Hartford, Conn.
Weston Elecl. Instrument Co., 582 Frelinghuysen Ave., Newark, N. J.
Zernickow Co., O., 15 Park Row, New York, N. Y.

TAGS, Cable; Pole and Battery

American Radio Hardware Co., 135 Grand, New York, N. Y. (Battery Lead Tags.)
Benedict Mfg. Co., East Syracuse, N. Y.
Berkshire Underground Elec'l Mfg. Co., Glenside, Pa.
Crowe Name Plate & Mfg. Co., 1749 Grace, Chicago, Ill.
Grammes & Sons, Inc., L. F., Allentown, Pa.
International Tag Co., 319 N. Whipple, Chicago, Ill.
Premax Products, Inc., Niagara Falls, N. Y.
Viking Tool & Machine Co., 745 65th, Brooklyn, N. Y.
Waterbury Button Co., Waterbury, Conn.

TAGS, Shipping

Campbell Paper Box Co., South Bend, Ind.
International Tag Co., 319 W. Whipple, Chicago, Ill.

TANK SWITCHES. See Switches, Tank.

TANKS, TINNING. See Wire Manufacturing Machines.

TAPE, Asbestos

American Asbestos Co., Norristown, Pa.
Asbestos Fibre Spinning Co., North Wales, Pa.
General Asbestos & Rubber Co., Charleston, S. C.
Johns-Manville Corp., New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Niagrite. See Johns-Manville, Inc.
Shield Brand. See Mitchell-Rand Mfg. Co.

TAPE, Cotton, Linen, Silk; Tape, Sleeving, Webbing.

Anchor Webbing Co., Nye, Pawtucket, R. I. (Cotton, Silk.)
Awebco. See Anchor Webbing Co.
Eagle. See Sidebotham, Inc., John.
General Electric Co., Schenectady, N. Y.
Glimer Co., L. H. (Tacony), Philadelphia, Pa.
Hope Webbing Co., 1005 Main, Providence, R. I.
Kimut & Pfte Mfg. Co., Allegheny Ave. & Emerald, Philadelphia, Pa.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pearce Co., R. T., Covington, Ky.
Shield Brand. See Mitchell-Rand Mfg. Co.
Sidebotham, Inc., John, 4317 Griscom, Philadelphia, Pa.
Smith Belting Co. (Germantown), Philadelphia, Pa.
Superfine. See Windsor Webbing Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Windsor Webbing Co., Pawtucket, R. I.
Worcester Braiding Co., 34 Southbridge, Worcester, Mass.

TAPE, Mica

Chicago Mica Co., 345 Campbell, Valparaiso, Ind.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mica Mfg. Co., 135 Johnson, Brooklyn, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

TAPE, Rubber and Friction

Ackerman. See Ackurate Rubber Co.
Ackurate Rubber Co., 25 Beaver St., New York, N. Y.
Adamson & Co., Joseph, Columbia and Germantown Aves., Philadelphia, Pa.
Athere. See Westinghouse Elec. & Mfg. Co.
Alpha. See Johns-Manville, Inc.
Amazon. See Graybar Elec. Co.
Appleton Rubber Co., Franklin, Mass.
Black Diamond. See Dunton Co., M. W.
Boston Woven Hose & Rubber Co., Boston, Mass.
Brooklyn. See Johns-Manville, Inc.
Bull-Dog. See Boston Woven Hose & Rubber Co.
Candee. See Ackurate Rubber Co.
Canfield Rubber Co., Bridgeport, Conn.
Canton. See Plymouth Rubber Co.
Clifton. See Clifton Mfg. Co.
Clifton Mfg. Co., 65 Brookside Ave., Boston 30, Mass.
Competition. See New York Insulated Wire Co.
Double-Wear. See Dryden Rubber Co.
Dryden Rubber Co., 1014 S. Kildare Ave., Chicago, Ill.
Dundee, A. & B. See Okenite Co.
Dunton Co., M. W., 670 Eddy St., Providence, R. I.
Dutch-Brand. See Van Cleef Bros.
Elkhart Rubber Wks., Elkhart, Ind.
Firestone Tire & Rubber Co., Akron, O.
General Electric Co., Section W-233, Merchandise Dept., Bridgeport, Conn.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y.
Grimshaw. See New York Insulated Wire Co.
Griptite. See Canfield Rubber Co.

Always the Same, Whatever the Weather

Success and Adversity appear to be equally powerful for testing the mettle of a man or a company. Some are overbearing in good fortune, and usually they lack the stamina to meet their obligations under reverses. In our more than 50 years, we have seen both smooth sailing and hard going at Robbins & Myers'. And it is rather a satisfaction to recall that there never was a Robbins & Myers contract that was not fulfilled to the letter as well as the spirit—never a Robbins & Myers promise to perform that wasn't kept to the dot. In flush times, R & M has been just as careful to preserve the same fair demeanor and always tried to be generous. These things, of course, are as they should be, yet Robbins & Myers' reputation for observing them probably is responsible for the solid friendship existing between us and our customers, new and old.

If you have a problem in electrical-motored machinery come to Robbins & Myers. We offer you the facilities of a completely modern plant, and the experience of 31 years' precision manufacture in designing, building and applying electric motors, generators, fans, and electrical appliances

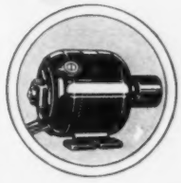
Partial List of Apparatus to which Robbins & Myers Motors have been successfully applied

Adding Machines	Confectioner's Machinery	Humidifiers	Movie Projectors
Advertising Displays	Conveyors	Ironing Machines	Portable Tools
Air Compressors	Dental Lathes	Labeling Machines	Printing Presses
Baker's Machinery	Dish Washers	Oil Burners	Spray Equipment
Blowers	Driers	Office Appliances	Ticket Selling Machines
Brick Machinery	Floor Surfacers	Organ Blowers	Vacuum Cleaners
Churns	Folding Machines	Mailing Machines	Ventilating Fans
Cloth Cutters	Heaters	Machine Tools	Unit Heaters
Coffee Mills	Heat Regulators	Meat Choppers	Washing Machines
Coin Counters	Hoists	Milking Machines	Wrapping Machines

Robbins & Myers, Inc.

Springfield, Ohio Brantford, Ontario

1878



1929

TAPE, Rubber and Friction—Continued
Holdfast Rubber Co., Atlanta, Ga.
Holdtite. See United States Rubber Co.
Hydro-Proof. See Elkhart Rubber Wks.
Imperial Rubber Co., 220 Broadway, New York N. Y.
Impervo. See Canfield Rubber Co.
Irco. See Imperial Rubber Co.
Johns-Manville Corp., New York, N. Y.
Jomanco. See Johns-Manville, Inc.
Kerite Ins. Wire & Cable Co., 30 Church, New York, N. Y.
Manson. See Okonite Co.
New York Insulated Wire Co., 114 Liberty, New York, N. Y.
Okonite Co., Passaic, N. J.
O. K. See Appleton Rubber Co.
P. & B. See Ruberoid Co.
Paratex. See Appleton Rubber Co.
Paruco. See Passaic Rubber Co.
Passaic Rubber Co., Clifton, N. J.
Plymouth Rubber Co., 1400 Revere, Canton, Mass.
Red-X. St. Louis Rubber Cement Co.
Rello. See United States Rubber Co.
Ruberoid Co., 95 Madison Ave., New York, N. Y.
S. I. See Superior Insulating Tape Co.
Slipknot. See Plymouth Rubber Co.
Star. See Sullivan & Sons Mfg. Co., J.
Sticks. See Graybar Elec. Co.
Stixwell. See Clifton Mfg. Co.
Sullivan & Sons Mfg. Co., J., 2224 N. 9th, Philadelphia, Pa
Superior Insulating Tape Co., 3044 Lambdin Ave., St. Louis
2-Plex. See Holdfast Rubber Co.
U. S. See United States Rubber Co.
United States Rubber Co., 1790 Broadway, New York, N. Y.
Van Cleef Bros., 7722 Woodlawn Ave., Chicago.
Victor. See Graybar Elec. Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa

TAPE, Varnished Fabric

Acme Wire Co., New Haven, Conn.
General Electric Co., Section W-233, Merchandise Dept., Bridgeport, Conn.
Irvington Varnish & Insulator Co., Irvington, N. J.
Mica Insulator Co., 200 Varick, New York, N. Y
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
New Jersey Wood Finishing Co., Woodbridge, N. J.
Radiotape. See Respro, Inc.
Respro, Inc., Wellington Ave. (Auburn), Providence, R. I
Shield Brand. See Mitchell-Rand Mfg. Co.
Stico. See Standard Insulator Co.
Standard Insulation Co., East Rutherford, N. J.
Voltape. See Respro, Inc.

TAPING MACHINES, Coil

Chapman Electric Works, P. E., 1820 Chouteau Ave., St Louis, Mo.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Griswold Machine Co., George, New Haven, Conn.
Ridlon Company, Frank, Boston, Mass.
Segur. See Electric Service Supplies Co.

TAPING MACHINES, Wire

American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
Wire Machinery Corp. of Am., New Haven, Conn.
TAPS. See Stocks, Dies and Reamers.
TENSION DEVICES, Coil Wire. See Racks, Wire Reel

TENSION MACHINES, Band Wire

Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.

TERMINALS AND CONNECTORS

Low Tension, Secondary Terminals and Connectors.
All-in-One. See Ohio Parts Co.
Barcy-Nicholson Co., 2801 Fort, W., Detroit, Mich.
Bassett Metal Goods Co., Derby, Conn. (General Selling Agent, Hatheway & Co., 16 Hudson, New York, N. Y.
Burton-Rogers Co., Boston, Mass.
Cabeling. See Jones, Howard B.
Clark Metal Products, 400 Hancock Ave., Bridgeport.
Dixie Supply Co., 91 7th Ave., New York.
Double Grip. See Pons, Eugene
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electron. See Bassett Metal Goods Co.
Fahnestock Elec. Co., East Ave. and 8th, Long Island City, N. Y.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Ideal Clamp Mfg. Co., 198 Bradford, Brooklyn, N. Y.
Jones, Howard B., 2226 Wabansia, Chicago, Ill.
K. E. M. See Kulier Elec. Mfg. Co.
Kulier Elec. Mfg. Co. 575 Pierce Ave., Long Island City
Morse Co., Frank W., Boston, Mass.
Nu-Way Snap. See Hatheway Mfg. Co.
Ohio Parts Co., 3301 Colerain Ave., Cincinnati, O.
Orum, S. R. M., 503 N. 11th, Philadelphia, Pa.
Patton-MacGuyer Co., Providence, R. I.
Pons, Eugene, 927 Campbell Ave., Schenectady, N. Y.
Peterson Co., 7 Beverly, Providence, R. I.
Rajah Co., Bloomfield, N. J.
Salem Elec'l Supply Co., Salem, Mass.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Shure. See Burton-Rogers Co.
Tinkerbox. See Weber Elec. Wks.
Waterbury, Button Co., Waterbury, Conn.
Weber Elec. Wks., Brooklyn Sta., Cleveland, O.
Wolverine Tube Co., 1415 Central Ave., Detroit, Mich.
Zierick Machine Wks., F. R., 6 Howard, New York.

TEST BENCHES, Armature

Allen Electric & Equipment Co., Kalamazoo, Michigan.
Burton & Rogers Co., Boston, Mass.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo.
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind
Hobart Bros. Co., Troy, Ohio.
Marshall Elec. Co., Elkhart, Ind.
Miho Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Pence & Son, H. O., San Luis Obispo, Cal.
Weidenhoff, Joseph, 4352 W. Roosevelt Road, Chicago, Ill
TESTING INSTRUMENTS. See Instruments.

TESTERS, Coil

(Includes Armature Growlers, trouble shooters, and other portable testing devices). See also Instruments
Ace. See Weidenhoff, Joseph.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Ankenbrandt, J. J., 2140 Wakeman, Toledo, Ohio.
Armeter. See Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.

Fischerarm

The best in flexible arms for portable and therapeutic lamps, etc.
MADE of steel and brass in all Finishes. Special arms designed to your requirements.
Write for prices.
CHAS. FISCHER SPRING CO.
438 Kent Avenue Brooklyn, N. Y.

For Supreme Musical Performance
THORDARSON
AUDIO & POWER TRANSFORMERS
THORDARSON ELECTRIC MFG. CO.
Transformer Specialists Since 1895
Huron and Kingsbury Sts., Chicago, Ill.

Bartlett Electric Products Co., Goshen, Ind. (Storage Battery).
Batt-O-Meter. See Indiana Mfg. & Elec. Co., also Case Elec.
Burton & Rogers Co., 857 Boylston, Boston, Mass.
Case Elec. Co., Marion, Ind.
Century Electrical Co., 102 Randall Ave., Syracuse, N. Y.
Chapman Elec'l Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Columbia. See Weidenhoff, Joseph.
Comparometer Co., New Ulm, Minn.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo.
Economy. See Weidenhoff, Joseph.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland.
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind.
Electrotest. See Comparometer Company.
Elmeo. See Electric Machine Corp.
Ev-Ri-Test. See Weidenhoff, Joseph.
Forest Electric Co., 272 New, Newark, N. J.
Ga-Jit. See General Instrument Corp.
General Instrument Corp., 225 Varick, New York, N. Y.
Herald Elec. Co., 29 East End Ave., New York, N. Y.
Hobart Bros. Co., Troy, Ohio.
Ideal. See Ankenbrandt, J. J.
Indiana Mfg. & Electric Co., Marion, Indiana.
Kletzman Electrical Mfg. Co., 234 N. Central, Gilman, Ill.
Leich Electric Co., Genoa, Ill.
Lundin Electric Machine Co., 10 Thacher, Boston, Mass.
Mallory Electric Co., Factories Bldg., Toledo, Ohio.
Marshall Elec. Co., Elkhart, Ind.
Miho Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn
Paneltest. See Forest Electric Co.
Portometer. See Forest Electric Co.
Portostat. See Forest Electric Co.
Presto. See Metal Specialties Mfg. Co.
Reliable Parts Mfg. Co., Wellington, Ohio.
Rex Batrystat. See Bartlett Products Co.
Scout. See Leich Electric Company.
Serrwell Sales Corp., 1749 N. Winchester Ave., Chicago, Ill
Test-All. See Colpin Corp.
Test-O-Meter. See Weidenhoff, Joseph.
Test-Rite. See Colpin Corp.
Victory. See Weidenhoff, Joseph.
Weidenhoff, Joseph, 4352 W. Roosevelt Rd., Chicago, Ill

TESTING LABORATORIES

Elec'l Testing Laboratories, 80th St. and East End Ave., New York, N. Y.
National Elec'l Inst. Co., 162 Sidney, Cambridge, Mass.
New York Testing Laboratories, 80 Washington, New York.
Rubicon Co., 29 N. Sixth, Philadelphia, Pa.
Stupakoff Laboratories, 6617 Hamilton Ave., Pittsburgh, Pa.
THERMO JUNCTIONS. See Instruments, Laboratory Standard.

THERMOSTATIC METAL

Chace Valve Co., W. M., 1600 Beard Ave., Detroit, Mich.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Cook Plate Co., Edw. N., 70 Ship, Providence, R. I.
Improved Seamless Wire Co., 775 Eddy, Providence, R. I
Interstate Products Corp., 29 Commercial, Newark, N. J.
Wilco. See H. A. Wilson Co.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

THERMOSTATS

American Thermostat Co., 226 Jelliff Ave., Newark, N. J.
Automatic Appliance Co., Jackson, Mich.
Bak-Rite. See Electric Appliance Mfg. Co.
Bishop & Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, O.
Boston Machine Wks. Co., 7 Willow, Lynn, Mass.
Brown. See Electric Automatic Appliance Co.
Brown Instrument Co., Wayne & Windrim, Philadelphia, Pa.
Burke Controller Co., 389 Lexington Ave., New York, N. Y.
Cobb Elec. Appliance Co., 100 Massachusetts Ave., Boston, Mass
Cramblett Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Diamond H. See Hart Mfg. Co.
Electric Automatic Appliance Co., Denver, Colo.
Electric Heat Control Co., 5002 Carnegie Ave., Cleveland, O.
Electric Maid. See Hankscraft Co.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Freas Thermo-Electric Co., 1206 S. Grove, Irvington, N. J.
Globe Mfg. Co., Battle Creek, Mich.
Hankscraft Co., 615 E. Washington, Madison, Wis.
Hart Mfg. Co., Hartford, Conn.
Hi-Lo. See Boston Machine Wks. Co.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Interstate Products Corp., 29 Commercial, Newark, N. J.
King. See Electric Heat Control Co.
Manhattan Elecl. Supply Co., 190 Sixth Ave., New York, N. Y.
Marvel. See American Thermostat Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill.
Moeller, A. E., 281 Sumpter, Brooklyn, N. Y.
Midget. See Coffin Mfg. Co., B. F.
National Steel Construction Co., 425 Fountenac, Seattle, Wash.
Pyrotherm. See Federal Gauge Co.
Safety Regulator Co., 529 S. Mathews, Los Angeles, Cal.
Sayutime Devices, Inc., 88 Manhattan, Rochester N. Y.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Standard Thermometer Co., 65 Shirley, Boston 19, Mass
Taglabue Mfg. Co., C. J., 18 33rd, Brooklyn, N. Y.
Teeple Co., L. R., 540 E. 9th, Portland, Ore.
Thermolectric. See Bishop & Babcock Sales Co.
Thermosnap. See Spencer Thermostat Co.
Time-O-Stat Controls Co., Elkhart, Ind.
Trent Co., Harold E., 439 N. 12th, Philadelphia, Pa.
Visaflame. See Mercoid Corp.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wilcolator Co., 17 Nevada, Newark, N. J.

TIGHTENERS, Commutator

Elmes Engineering Works, Chas. F., 222 N. Morgan, Chicago, Ill.
TIME SWITCHES. See Switches, Time.
TINNING TANKS, WIRE. See Wire Manufacturing Machines.
TINSEL. See Wire, Insulated.

TIPS, Cord

Duro. See McEvoy, C. H.
McEvoy, C. H., 430 Broadway, Lowell, Mass.
National Acme Mfg. Co., 7500 Stanton Ave., Cleveland, O.
Nordon & Co., S. 180 S. Water, Providence, R. I.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y.
Waterbury Brass Goods Corp., Waterbury, Conn.
TOOLS, Commutator Slotting. See Slotting Machines & Tools, Commutator.

TOOLS, Commutator Truing

Acme. See Green Equipment Corp.
Allen Elec. & Equipment Co., N. Pitcher St., Kalamazoo, Mich.
Binghamton Flexible Shaft Co., Binghamton, N. Y.
Central Mfg. Co., Fairfield, Ia.
Green Equipment Corp., Monadnock Block, Chicago, Ill.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill.
Imperial. See Martindale Elec. Co.
Jordan Bros., 74 Beekman, New York, N. Y.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, Ohio.

TOOLS, Storage Battery

Battery Equipment & Supply Co., 7530 Greenwood Ave., Chicago, Ill. Burning Racks, Battery Trucks, Plate Pressers, Mallets, Lead Burners and Strainers.
Battery Parts Co., Inc., Wilkinsburg, Pa. (Leads.)
Battery Tools Co., 29 Willow, Montclair, N. J.
Besco. See Battery Equipment & Supply Co.
Bobbett Elec. Mfg. Co., 811 E. 43rd St., Chicago, Ill. (Knife Heaters.)
Canedy-Otto Mfg. Co., 1816 McGee, Chicago Heights, Ill. (Floor Vises.)
General Elec. Co., Schenectady, N. Y. (Lead Burning Outfits.)
Heet-A-Knife. See Op-al Elec. & Mfg. Co.
Ohio Parts Co., 3301 Colerain Ave., Cincinnati. (Terminals.)
Op-al Elec. & Mfg. Co., 1057 E. 30th St., Indianapolis, Ind. (Knife Heaters.)
Orum, S. R. M., 503 N. 11th, Philadelphia, Pa. (Pillar Post Sleeves, Tongs, Reamers, Strap Punches, Terminal Pullers, Steamers, Racks or Stands, Terminal Post Shapers, Battery Analyzer, Post Sealing Machine, Plate Burning Press, Press and Stands.)
Pyralip. See General Elec. Co.
Reliable Parts Mfg. Co., Wellington, O. (Steamer and Still, Filler, Separator Cutter, Clips, Carrier, Post Cutter, Terminal and Cell Puller.)
Thompson Mfg. Co., Meadville, Pa. (Reamers, Terminal Post Pullers, Pressing Tongs.)

TORCHES AND FURNACES

Acetylene, Alcohol, Gasoline, Kerosene.
Bernz Co., Otto, Newark, N. J.
Clayton & Lambert Mfg. Co., Detroit, Mich.
Dreadnaught. See Wall Mfg. Supply Co.
Klein & Sons, Mathias, Chicago, Ill.
Lasher-Peerblow Co., 237 Harrison Ave., Boston, Mass.
McGill Mfg. Co., Valparaiso, Ind.
Peerless. See Lasher-Peerblow Co.
Staysalite. See Klein & Sons, Mathias.
TORPEDO Cord. See Twine.
TORSION BALANCES. See Instruments, Laboratory Standard

TRANSFORMERS

Radio. See Radio Circuit Components.
Gas Tube Sign. See Transformers, Oil Burner.
Oil Burner Ignition. See Transformers, Low & Intermediate Voltage.

TRANSFORMERS, Low and Intermediate Voltage

For Oil Burners, Gas Tube Signs, and other special purposes.
American Bosch Magneto Corp., Springfield, Mass.
American Transformer Co., Newark, N. J.
Campbell Elec. Mfg. Co., Lynn, Mass.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
General Electric Co. (Merchandise Dept.), Bridgeport, Conn.
Manhattan Elecl. Supply Co., 190 Sixth Ave., New York, N. Y.
Sorgel Electric Co., 89 W. Water, Milwaukee, Wis.
Standard Transformer Co., Warren, O.
Thordarson Elec. Mfg. Co., Huron & Kingsbury Sts., Chicago, Ill.
Uptigraff Mfg. Co., R. E., First National Bank Bldg., Pittsburgh, Pa.
Ward Leonard Elec. Co., Mt. Vernon, N. Y.
Webster Electric Co., Racine, Wis.
TRANSMISSION DRIVES. See Chain, Transmission.

TRANSMITTERS, Power

Controller drive giving a variety of speeds for use in connection with coil taping machines.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Segur. See Electric Service Supplies Co.
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TRUING Devices, Commutator. See Tools, Commutator.
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Brass. See Tubing, Brass.
Condenser. See Tubing, Brass and Copper.
Copper. See Tubing, Brass.
Cutters. See Stocks, Dies, etc.
Fibre. See Fibre.
Fibre Candle. See Candles.
Mica. See Mica.
Paper. See Tubes, Paper.
Platinum. See Platinum.
Pyrometer. See Cores, Resistance.
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Anaconda. See American Brass Co
Baltimore Tube Co., Baltimore, Md.
Bridgeport Brass Co., Bridgeport, Conn.
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Conzlin Brass & Copper Co., T. E., 54 Lafayette, New York.
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Dallas Brass & Copper Co., 820 Orleans, Chicago, Ill.
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Mueller Brass Co., Port Huron, Mich.
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National Electric Products Corp., Pittsburgh, Pa.
Randolph Clowes Co., Waterbury, Conn.
Relleum. See Mueller Brass Co.
Roberts Tube Works, 2500 Military Ave., Detroit, Mich.
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Electro Thermal-Unit Co., 44 N. Fourth, Philadelphia, Pa.
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VARNISHED TUBING. See Tubing, Varnished Fabric.

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VOLTMETERS. See Instruments.

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Positive Lock Washer Co., Ave. A & Miller, Newark, N. J.
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Chatterton's Compound .....See C
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Ajax. See Sherwin-Williams Co.
Asphalt Products Co., 6531 S. State, Chicago.... S . .
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Biwax Corp., 208 S. La Salle, Chicago, Ill.... W S . .
Black Nego. See Williams Co., F. M.
Bulls-Eye. See Zinsser & Co.
Candy & Co., 35th and Maplewood Ave., Chicago W S . .
Clifton Mfg. Co., 65 Brookside Ave., Boston..... . . C
Cochrane Chemical Co., 432 Danforth Ave., Jersey City, N. J. ..... W S . .
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Di Electric Puttis. See Ackurate Rubber Co.
Ever-Protect. See National Cable Compound Co.
Flake White. See Williams Co., F. M.
General Electric Co., Section W-233, Merchandise Dept., Bridgeport, Conn..... W . . .
Globe Chemical Co., Murray Road & Big 4 R. R. St., Bernard, Cincinnati, O..... W S . .
Golde Brown. See Williams Co., F. M.
Great Lakes Thread & Yarn Co., 5133 Wesson Ave., Detroit, Mich..... W . . .
Hexsulate. See Tar Products Corp.
Imco. See Great Lakes Thread & Yarn Co.
India Red Seal. See Williams Co., F. M.
Insulatine Co., 1 Broadway, New York..... W . . .
Knox & Morse Co., 80 Freeport, Boston, Mass..... W S . .
Leverite. See Mitchell-Rand Mfg. Co.
Lime Seal. See Mitchell-Rand Mfg. Co.
McGill Mfg. Co., Valparaiso, Ind..... . . C
Mineralac Elec. Co., 1045 Washington Blvd., Chicago, Ill. ..... W . . .
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Nu-Blac. See Star Porcelain Co.
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Rubberseal. See Mitchell-Rand Mfg. Co.
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Seidner & Ehequist, Inc., 86 Hausman, Brooklyn, N. Y. ..... W . . .
Sherwin-Williams Co., Cleveland, O..... W . . C
Standard Varnish Wks., 433 4th Av., New York.. W . . .
Standard Wax & Import Co., 110 E. 42nd, New York, N. Y. ..... W S . .
Star Porcelain Co., Trenton, N. J..... W . . C
Tacrite. See Seidner & Ehequist, Inc.
Tar Products Corp., Providence, R. I.
Trotter & Co., E. T., 576 Johnson Ave., Brooklyn, N. Y. ..... W S . .
Waverly Oil Wks., 54th and A. V. R. R., Pittsburgh, Pa. ..... S . .
Williams Co., F. M., 1238 Prospect Ave., Brooklyn, N. Y.
Zinsser & Co., 48 Vesey, New York, N. Y..... W . . .

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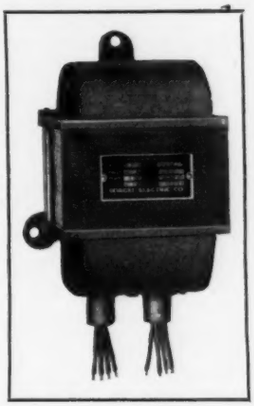

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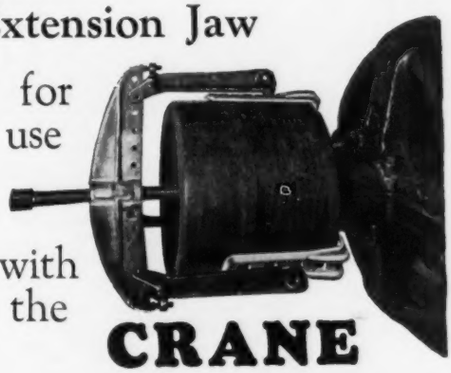

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Filament. See Machines, Lamp Making.
Induction Coil. See Winding Machines, Induction Coil.
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Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Browning. See Mutual Foundry & Machine Co.
Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Conran, Frederick M., 177 New York Ave., Newark, N. J.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Globe Technolian Corp., Reading, Mass.
Fredericks Co., H. M., Lock Haven, Pa.
Handy. See Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Herald Elec. Co., 29 East End Ave., New York, N. Y.
Hunsdorf, Wm., 2056 E. Fourth, Cleveland, O.
Liberty Starter Co., W. Fort & Minnie Sts., Detroit, Mich.
Line, W. C., 208 S. Geddes, Syracuse, N. Y.
Lyknu. See Fredericks Co.
Munsdorf Company, W. P., 720 Frankfort, Cleveland, Ohio.
Mutual Foundry & Machine Co., Atlanta, Ga.
Oman, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Segur. See Electric Service Supplies Co.
Superior. See Armature Coil Equipment Co.

WINDING MACHINES, Induction Coil
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Conron, Frederick M., 177 New York Ave., Newark, N. J.
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind.
Easton Coil Co., Easton, Pa.
Electrical Products Mfg. Co., Providence, R. I.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Leesona. See Universal Winding Co.
Line, W. C., 208 S. Geddes, Syracuse, N. Y.
Morris Register Co., 29th & Broadway, Council Bluffs, Iowa.
Radio Production Machinery Co., 212 Centre, New York.
Ridlon Company, Frank, 253 A St., Boston, Mass.
Universal Winding Co., Boston, Mass.
Viking Tool & Machine Co., 747 65th St., Brooklyn, N. Y.
Weber & Scher Mfg. Co., 263 Sussex Ave., Newark, N. J.
Weehawken Engineering Co., 543 Gregory Ave., Weehawken, N. J.
WINDINGS. See Coils, Finished.

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Athey Co., 6132 West 65th St., Chicago, Ill.
WIRE (Cable) (Cord), Aluminum. See Aluminum.
Copper Clad. See Wire, Copper Clad.
Forms. See Forms, Wire.
Frames. See Forms, Wire.
Fuse. See Fuses and Fuse Wire.
Molybdenum See Molybdenum.
Phosphor Bronze. See Phosphor Bronze.
Platinum. See Platinum.
Radio Bus. See Wire, Bare.
Scrapers. See Scrapers, Wire.
Strippers. See Scrapers, Wire;
Tungsten. See Filament, Incandescent Lamp.

WIRE, Bare
Armature Banding ..... See S
Copper Wire ..... See C
Iron Wire ..... See S
Phosphor Bronze ..... See R
Radio Bus Wire ..... See C
Resistance Wire ..... See R
Steel Wire ..... See S

Acme. See Alloy Metal Wire Co.
Advance. See Driver Harris Wire Co.
Alloy Metal Wire Co., Moore, Pa. ..... C R
American Brass Co., 25 Broadway, New York,
American Copper Products Corp., 233 Broadway, New York, N. Y. ..... C R
American Electrical Works (Philipsdale), Providence, R. I. C
American Insulated Wire & Cable Co., Div. of General Cable Corp. 954 W. 21st, Chicago.... C S
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. ..... C S
Anaconda. See American Brass Co.
Anylite Elec. Co., Fort Wayne, Ind. C
Ballast. See Gilby Wire Co.
Baltimore Copper Mills (Div. of General Cable Corp.), Baltimore, Md. C
Bassett Metal Goods Co., Derby, Conn. (General Sales Agent, Hatheway & Co., 16 Hudson, New York, N. Y. C
Belden Mfg. Co., 2310B S. Western Ave., Chicago C S
Beldenite. See Belden Mfg. Co.
Bradford, Kyle & Co., Plymouth, Mass. ..... R
Braidite. See Cornish Wire Co.
Brenvar. See American Insulated Wire & Cable Co.
Bridgeport Brass Co., Bridgeport, Conn. C

Calido. See Driver Harris Wire Co.
Chromel. See Hoskins Mfg. Co.
Chromic. See Murray-Harris Wire Co.
Climax. See Driver Harris Wire Co.
Comet. See Driver Harris Wire Co.
Comin. See Gilby Wire Co.
Cook Plate Co., Edw. N., 70 Ship, Providence, R. I. C
Copel. See Hoskins Mfg. Co.
Copperweld Steel Co., Glassport, Pa. ..... C S
Cornish Wire Co., 30 Church, New York, N. Y.. C
Corwico. See Cornish Wire Co.
Crape. See Indiana Steel & Wire Co.
Crescent Ins. Wire & Cable Co., Trenton, N. J.. C
Cupron. See Gilby Wire Co.
Darow Mfg. Co., 97 Greene, New York, N. Y... C
Detroit Insulated Wire Co., Detroit, Mich..... C
1885. See Chicago Insulated Wire & Mfg. Co.
Driver Harris Wire Co., Harrison, N. J..... R
Electron. See Bamett Metal Goods Co.
Excellcier. See Branford Elec. Co.
Fullman Mfg. Co., 1209 Jefferson, Latrobe, Pa.. .. ..
Gilby Wire Co., Riverside Ave., Newark, N. J.... R
Goldmark Co., James, 83 Warren, New York.. C
Hope Webbing Co., Providence, R. I. (Braided Wire Tape) C
Hoskins Mfg. Co., 4445 Detroit, Mich..... C R
Hudson Wire Co., Ossining, N. Y..... C R
Ideal. See Driver Harris Wire Co.
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. ..... C S
Indiana Steel & Wire Co., Muncie, Ind ..... S
Inland Wire & Cable Co., Sycamore, Ill..... C
Karma. See Driver Harris Wire Co.
Keystone. See Fullman Mfg. Co.
Lucero. See Driver Harris Wire Co.
Marion Insulated Wire & Rubber Co., Marion, Ind. C
Monex. See Standard Alloy Wire Co.
National-Harris Wire Co., 113 Orchard, Newark.. R
Nehring Electrical Works, De Kalb, Ill. C
Nichrome. See Driver Harris Wire Co.
Novar. See Standard Alloy Wire Co.
Page Steel & Wire Co., Bridgeport, Conn. ..... S
Paranite. See Indiana Rubber & Insulated Wire Co.
Peerless. See Alloy Metal Wire Co.
Phillips Wire Co., Pawtucket, R. I. C
Phono-Electric. See Bridgeport Brass Co.
Premier. See Alloy Metal Wire Co.
Providence Insulated Wire Co., Providence, R. I.. C
Race. See Ross Wire Co.
Revolute Wire Co., Hastings-on-Hudson, N. Y.... C
Roebling's Sons Co., John A., Trenton, N. J..... C S
Rome Wire Co., Div. of General Cable Co., Rome, N. Y. C
Ross Wire Co., 69 Bath, Providence, R. I. C
Silcrimp. See Valley Narrow Fabric Co.
Seneca Wire & Mfg. Co., Fostoria, O. ..... S
Solar. See Gilby Wire Co.
Sparg Wire Co., J. A., Rome, N. Y..... C
Standard Alloy Wire Co., Elizabeth, N. J. ..... R S
Standard Underground Cable Co. (Div. of General Cable Corp.), Pittsburgh, Pa. C
Super-Insulated Wire Co., Plymouth, Mass. C
Superior. See Alloy Metal Wire Co.
Talking Tape. See Hope Webbing Co.
Therlo. See Driver Harris Wire Co.
Tophet. See Gilby Wire Co.
Tru-Lay. See Page Steel & Wire Co.
Valley Narrow Fabric Co., Falls, R. I.
Wheeler Insulated Wire Co.. Bridgeport, Conn.. C

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WIRE, Insulated

KEY

Annunciator, Office, Bell Wire....See A
Asbestos Covered Heater Cord.....See H
Asbestos Covered Magnet Wire....See M
Enameled Magnet Wire .....See M
Fixture Wire .....See R
Flexible Reinforced Heavy Duty Cord .....See F
Heater Cord .....See H
Ignition Cable .....See R
Lamp Cord .....See R
Magnet Wire .....See M
Rubber Covered Wire & Cable..See R
Stove Wire .....See H
Telephone Cord .....See T

A-A Wire Co. (Div. of General Cable Corp), 420 Lexington Ave., N. Y. C.. R .. ..
A-1 Brand. See American Insulated.
Acme Wire Co., New Haven, Conn.
Enamaled Silk, Cotton ..... M
Amelectric. See American Elec.
American Brand. See American Insulated Wire & Cable Co.
American Brass Co., 25 Broadway, New York, N. Y. ..... A .. M ..
American Copper Products Corp., 233 Broadway, New York, N. Y. ....
American Electrical Works (Philipsdale), Providence, R. I. ..... M
American Enameled Magnet Wire Co., Muskegon, Mich. ..... M
American Insulated Wire & Cable Co. Div. of General Cable Co., 954 W. 21st, Chicago, Ill. ..... M
American Insulated Wire Corp., Div. of General Cable Co., 45 Baker, Providence, R. I. ..... R F .. A T ..
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. ..... R F H A T M
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Beldenamel. See Belden Mfg. Co.
Beldenite. See Belden Mfg. Co.
Bishop Wire & Cable Corp., 420 E. 25th, New York, N. Y..... R F .. ..
Boston Insulated Wire & Cable Co., 65 Bay, Boston, Mass. ..... R F H .. .. ..
Bradford, Kyle & Co., Plymouth, Mass. .. .. M
Cablex. See Collyer Insulated Wire Co.
Celatsite. See Acme Wire Co.
Collyer Insulated Wire Co., Pawtucket, R. I. ..... R F H .. .. ..
Colorbeston. See General Elec. Co.
Condex. See Simplex Wire Co.
Colorubber. See Belden Mfg. Co.
Copperweld Steel Co., Rankin, Pa..... R .. ..
Cotenamel. See Belden Mfg. Co.
Cottonite. See Acme Wire Co.
Crescent Ins. Wire & Cable Co., Trenton, N. J. ..... R F H A T M
Darow Mfg. Co., 97 Greene, New York, R .. ..
Davis-Jones Insulated Wire Co., Pawtucket, R. I. ..... R F H A T ..
Deltabeston. See York Insulated.
Detroit Insulated Wire Co., Detroit, Mich. R .. .. .. T ..
Diamond Braiding Mills, Chicago Heights R F H .. .. M
Dreadnaught. See Indiana Rubber Co.
Driver-Harris Co., Harrison, N. J..... R .. H .. .. ..
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind.. .. .. M
Durablit. See Tubular Woven.
Duracord. See Tubular Woven.
Durawire. See Tubular Woven.
Duro. See McEvoy, C. H.
Eagle. See Goldmark Co., James.
Eastern Insulated Wire Co., Tilton, N. H. R .. ..
1885. See Chicago Insulated Wire.
Enamelite. See Acme Wire Co.
Fibrex. See Simplex Wire Co.
Flexible Woven Cable Co., 755 Boylston, Boston, Mass. ..... F .. ..
Flex-O-Cord. See Packard Elec. Co.
Garco. See General Asbestos Co.
Garrit Mfg. Co., West Brookfield, Mass. .. .. T ..
GE-Flex. See General Elec. Co.
General Asbestos & Rubber Co., Charleston, S. C. ..... H .. ..
General Elec. Co., Section W-233, Merchandise Dept., Bridgeport, Conn.... R F H .. .. M
Giant. See Collyer Insulated Wire.
Goldmark Co., James, 83 Warren, New York, Annunciator and Asbestos, Cotton, Silk and Enameled Magnet ..... A .. M
Goodyear Rubber Insulating. See Graybar Electric Co.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y. R .. .. .. T ..
Grimshaw. See New York Ins.
Hatfield Rubber Wks., Inc., Hillside, N. J. R .. H .. .. ..
Hazard Insulated Wire Works, Div. of Okonite Co., Wilkes-Barre, Pa.... R F .. A .. M
Holyoke Co., 621 Broadway, New York.. R .. .. A .. M
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. ..... R F H .. .. ..
Inland Wire & Cable Co., Sycamore, Ill. R W .. A .. M
I. X. L. See Collyer Insulated.
Kable. See Safety Cable Co.
Kenrite. See American Insulated.
Kerite Ins. Wire Cable Co., 30 Church, New York, N. Y. ..... R .. ..
Kilo, Co., 2 E. 23d, New York..... .. .. .. T M
Koelle, Frederick C., Real Estate Trust Bldg., Philadelphia, Pa. .... T ..
Liberty. See Nat. Metal Molding.
Lowell Insulated Wire Co., Lowell, Mass. R F H .. .. ..
Lonsteel. See Hazard Insulated Wire Works.
McEvoy, C. H., Lowell, Mass..... R .. .. .. T ..
Maring Wire Co., Muskegon, Mich. Cotton, Silk, Enameled .... M
Marion Insulated Wire & Rubber Co., Marion, Ind. ..... R F H A T ..
Massachusetts Elec. Mfg. Co., West Lynn, Mass. .... M
Montgomery Co., J. R., Windsor Locks, Conn. .... T ..
National Elec. Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa..... R F H A T M
N. E. See Goldmark Co., James.
New England Wire Co., Westfield, Mass.. R .. H .. T ..
New York Insulated Wire Co., 114 Liberty, New York, N. Y. ..... R .. ..
Nitro. See Belden Mfg. Co.
O. K. See Phillips Wire Co. Also Southern Cable Co.
Okocord. See Okonite Co.
Okonite Co., Passaic, N. J..... R .. ..
Ozex. See Simplex Insulated Wire
Packard Electric Co., Warren, O..... R F .. ..
Parac. See Phillips Wire Co.
Paracore. See U. S. Rubber Co.
Paraflex. See Bishop Wire & Cable.
Paranite. See Indiana Rubber.
Parkerite. See Seward Wire Co.
Peco. See Packard Elec. Co.
Philadelphia Insulated Wire Co., 200 N. Third, Philadelphia, Pa..... .. .. H A T ..
Phillips Wire Co., Pawtucket, R. I..... R .. ..
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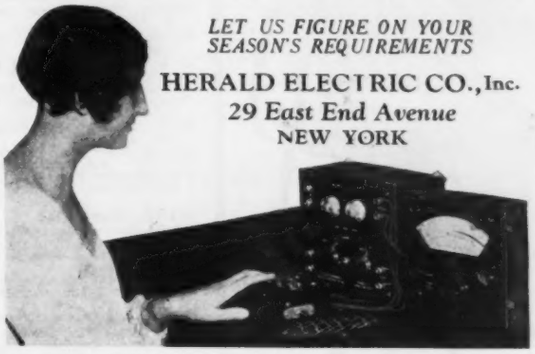

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Varflex Corp., Rome, N. Y. ..... M
Warrior. See American Copper.
Wheeler Insulated Wire Co., Bridgeport, Conn. ..... R F H A T M
White, J. M., 1128 Oliver, Philadelphia, Pa. ..... R F H . . T . .
Whitney Blake Co. See Graybar Electric Co.
Wovenite. See Flexible Woven.
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Adamson Machine Co., Akron, Ohio.. I A . . . . . .
Aimco-Seward. See American Insulating Machinery Co.
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa. I A . . . . S U F
Breguet. See American Insulating Machy.
Crescent. See Royle & Sons, John.
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Nebuttco. See New England Butt Co.
New England Butt Co., 324 Pearl, Providence, R. I. ..... I A B M S U . .
Peerless. See Royle & Sons, John.
Royle & Sons, John, Paterson, N. J. I . . . . . .
Sleeper & Hartley, Inc., Worcester, Mass. ..... A . . . . S U
Terkelson Machine Co., 326 A St., Boston, Mass. ..... M . . . . .
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Universal Wire Machy. Co., 69 Daggett, New Haven, Conn. ..... A . . . . . U F
Utility Mfg. Co., Cudahy, Wis. ..... I . . . . . .
Wardwell Braiding Machine Co., Central Falls, R. I. ..... B . . . . . .
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Woods Metal. See Radio Mountings.

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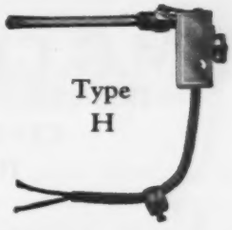

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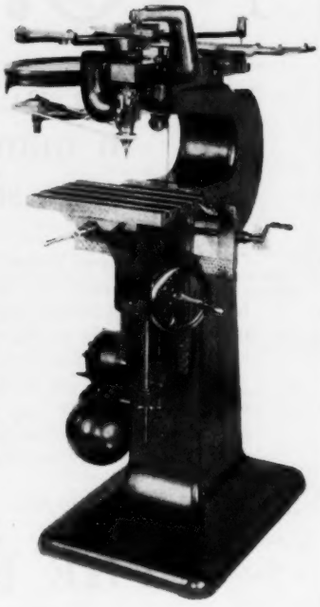

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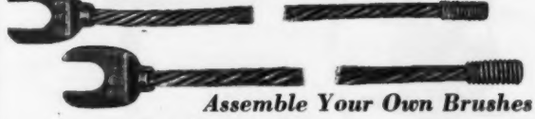

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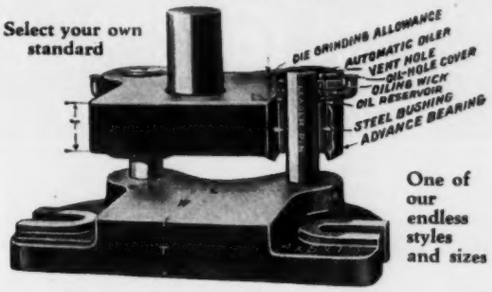

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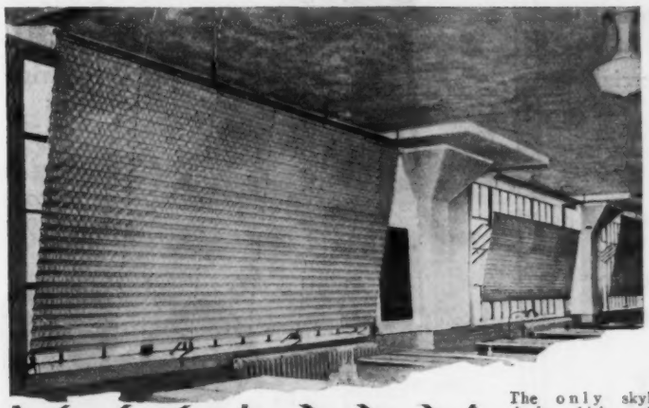

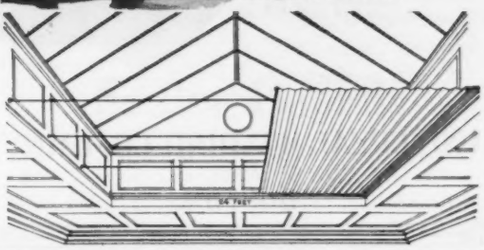

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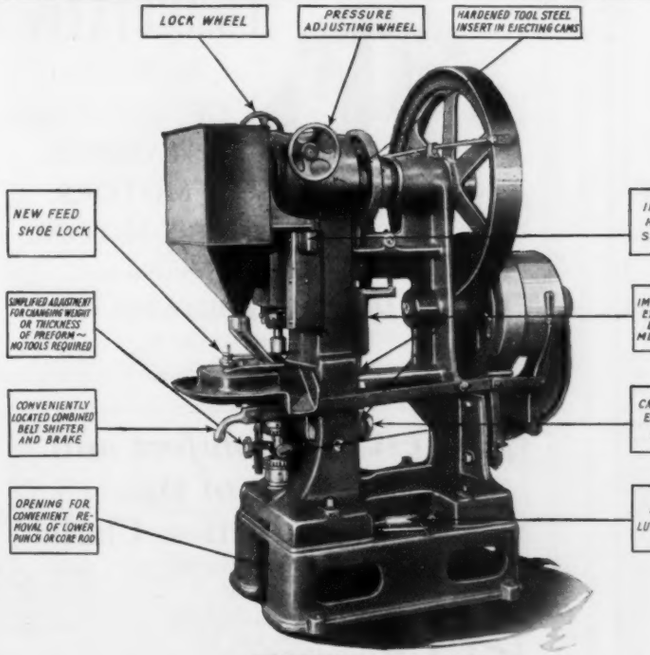
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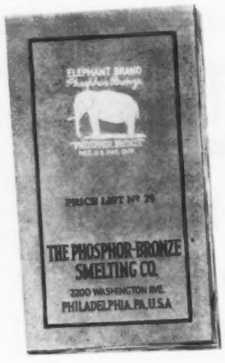

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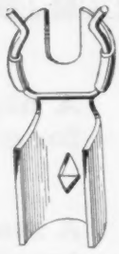

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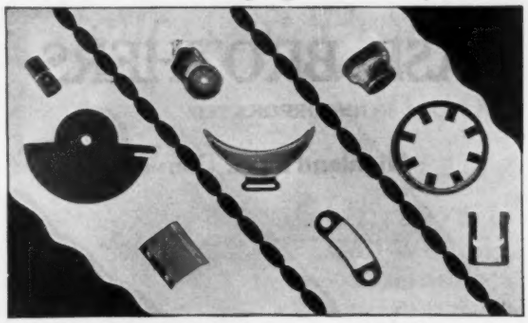

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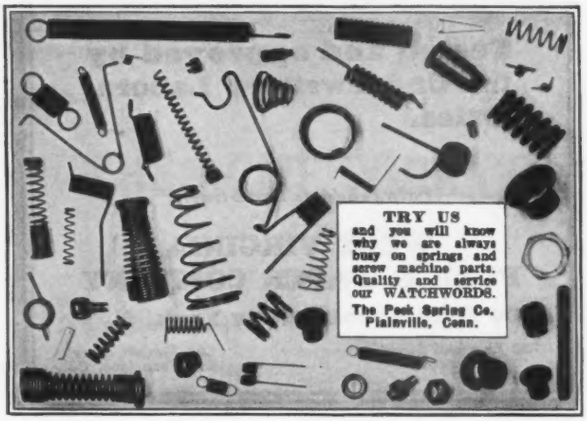

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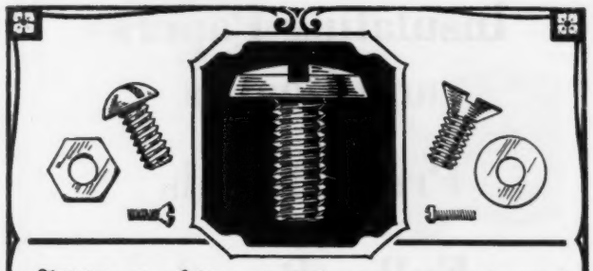

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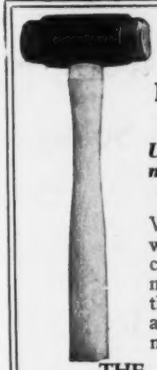

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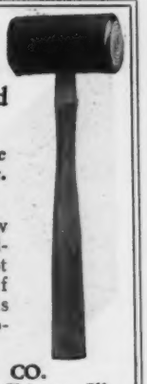

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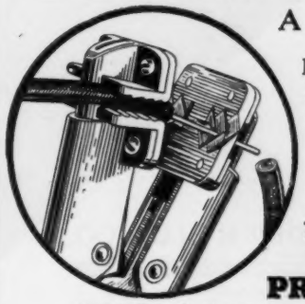

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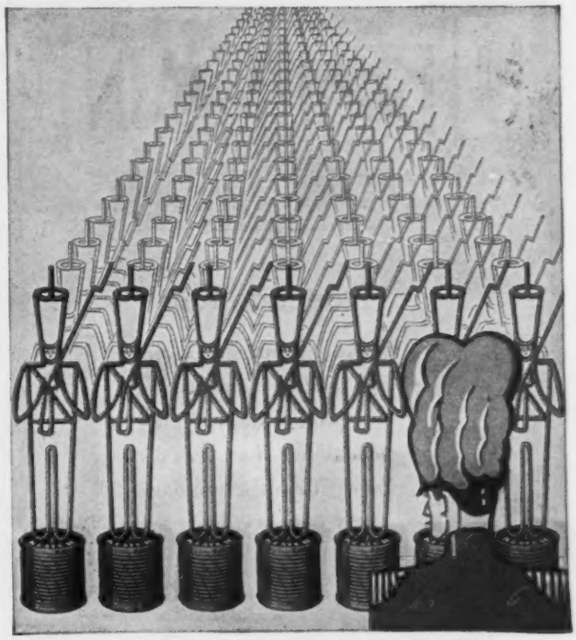

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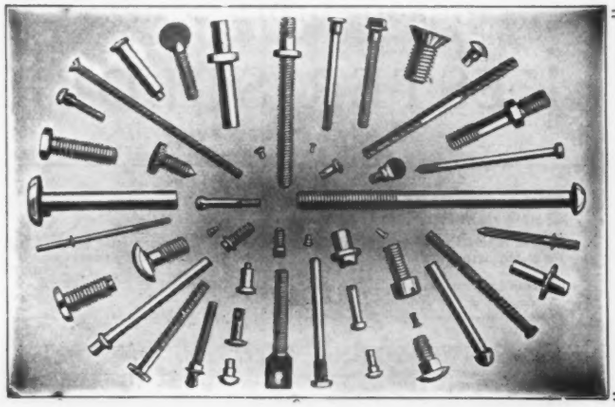

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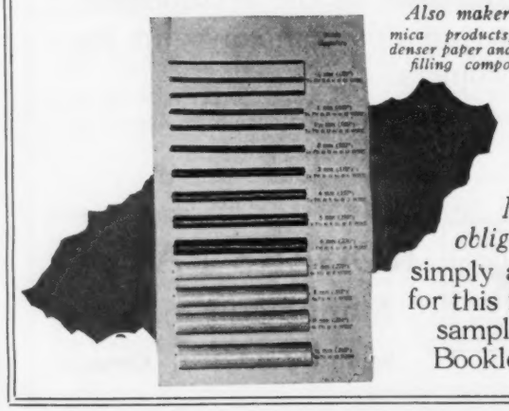

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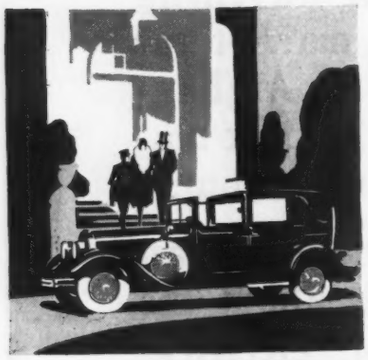
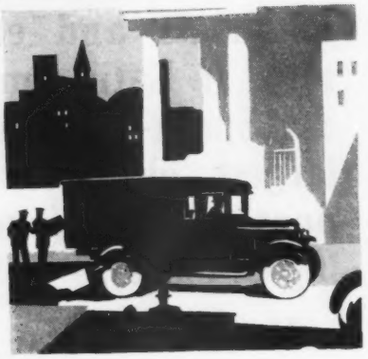
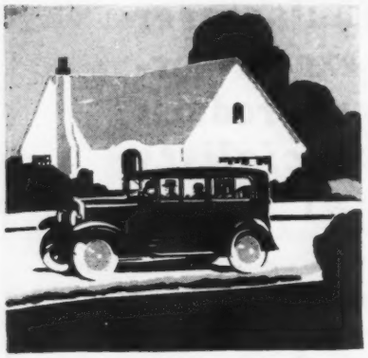


the wealthy man's car

the business man's car





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[Division of Illinois Tool Works]
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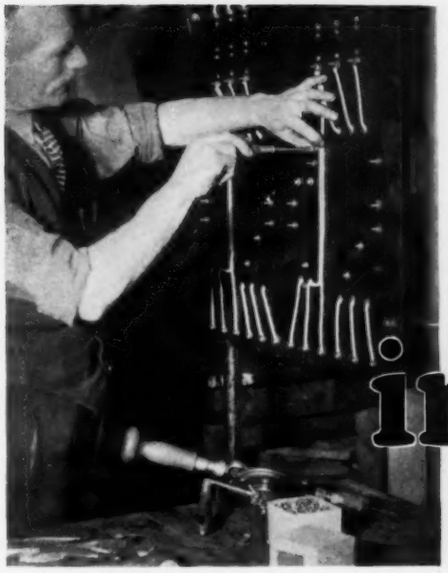

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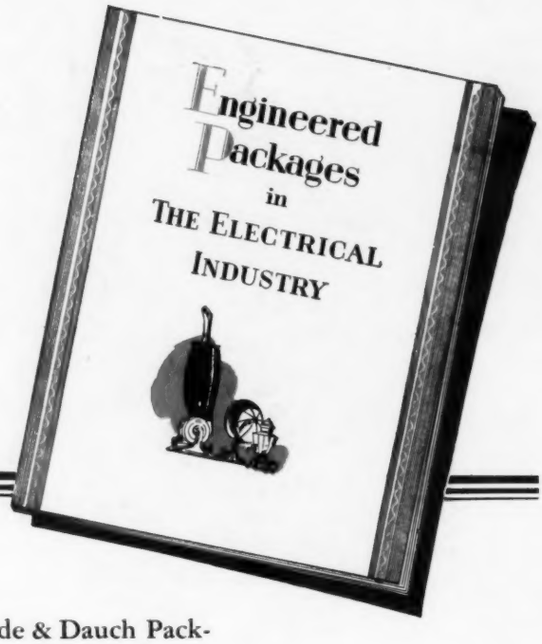
A Treatise *on* Packaging



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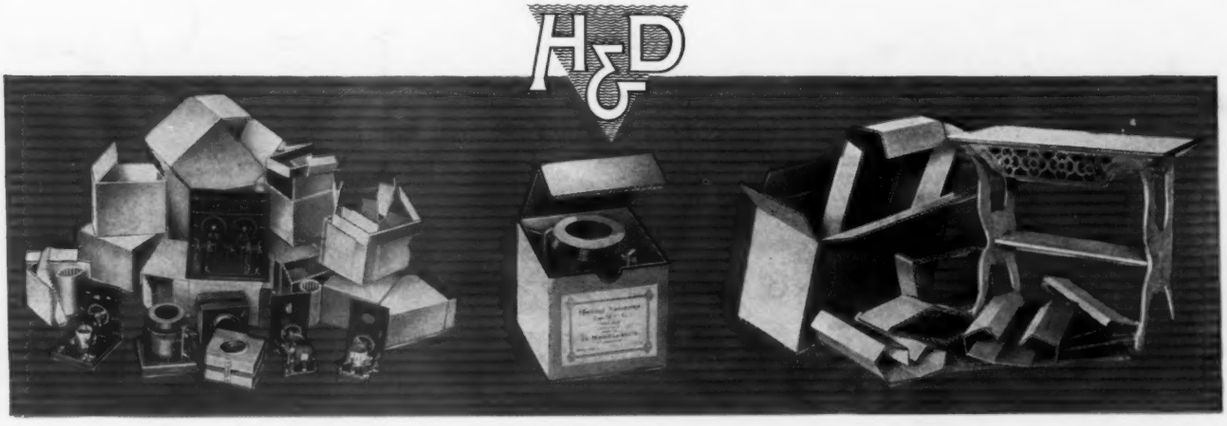
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